Omaha Douglas Public Building Commission

OMAHA, NEBRASKA

Courthouse Renovation Project

Design Documents
Project Manual

June 22, 2015

Client Project Number: 14043

HDR Project No. 010249/241937

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June 22nd, 2015

REQUEST FOR PROPOSALS

Dear Contractor:

Notice is hereby given that the Omaha Douglas Public Building Commission will receive sealed bids until 10a.m. July, 27th, 2015, for The Courthouse Renovation Project in the Hall of Justice Complex.

Bidding Documents may be viewed in the Office of the Administrator, Suite 1205, Omaha-Douglas Civic Center, 1819 Farnam Street, Omaha, Nebraska 68183, and shall be available for purchase through the plan distribution service provider as indicated in specification section 00 11 13 Advertisement To Bid. There will be a mandatory walkthrough and prebid conference on Saturday June, 27th, 2015, at 10 a.m. beginning in the Administrator’s Office, Room 1205, Civic Center, 1819 Farnam Street, Omaha, NE. To reach the 12th floor of the Civic Center, take any Civic Center elevator to the 11th floor and the steps up to 12 or have the security guard at the Kiosk on Farnam Level call the one elevator that goes to the 12th floor.

As evidence of good faith in submitting a proposal on the above, the bidder must file with his proposal a bid bond, certified check or cashier's check in the amount of 5% of the bid.

The Omaha Douglas Public Building Commission reserves the right to accept or reject any or all bids.

Bids will be publicly opened at 10 a.m., July, 27th, 2015, and the bid will be awarded at the next scheduled meeting of the Omaha Douglas Public Building Commission, which is currently scheduled for August 13th, 2015, at 8:30a.m.

Please use a sealed envelope in bidding and mark same 'Building Commission Courthouse Renovation Project' for 10 a.m., July 27th, 2015.

Questions may be directed to 402-444-5345.

Sincerely,

Paul G. Cohen
Administrator

SPECIFICATIONS FOR THE COURTHOUSE RENOVATION PROJECT
OMAHA DOUGLAS PUBLIC BUILDING COMMISSION

Project #14043

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SUBMITTAL/PROPOSAL

DOCUMENTS

SUBMITTAL DOCUMENTS

The following documents are required to be submitted by the CONTRACTOR at the time designated:

DOCUMENT	RECEIVED	SUBMITTAL TIME
BID BOND	( )	SPECIFIED BID
BID FORM DATE/TIME	( )	SPECIFIED BID
CERTIFICATE OF INSURANCE CONTRACT	( )	10 DAYS AFTER CONTRACT SIGNING
LICENSES CONTRACT	( )	10 DAYS BEFORE START DATE
MANUFACTURERS TECHNICAL LITERATURE, SPECIFICATIONS, & MATERIAL AND DATA SHEETS (4 COPIES) CONTRACT	( )	10 DAYS AFTER CONTRACT SIGNING
EMERGENCY PHONE NUMBERS CONTRACT	( )	10 DAYS BEFORE START DATE
PERFORMANCE AND PAYMENT BOND	( )	10 DAYS BEFORE START DATE
WORK SCHEDULE CONTRACT	( )	15 DAYS BEFORE START DATE

PROPOSAL PAGE

Instructions: Bidder shall submit a proposal for work on this document and the required attachments and deliver to the BUILDING COMMISSION as instructed in the REQUEST FOR PROPOSAL.

PROJECT NAME: Courthouse Renovation Project

PROJECT NUMBER: 14043

PROPOSAL:

Courthouse Renovation (Base Bid) $_____

Contingency Allowance $_____

TOTAL CONTRACT $_____

Unit Price

Acknowledged Receipt of Addendums _____ through _____.

COMPANY:_____

ADDRESS:_____

CITY/STATE/ZIP CODE_____

PHONE _____ FAX_____

BY: _____Signature

_____Name Printed

_____Title

DATE OF PROPOSAL_____

GENERAL CONDITIONS

AND

REQUIREMENTS

OMAHA DOUGLAS PUBLIC BUILDING COMMISSION

GENERAL CONDITIONS OF THE CONTRACT
FOR
SERVICES

These General Conditions shall be a part of the Contract executed by and between the Omaha Douglas Public Building Commission (hereinafter referred to as the BUILDING COMMISSION) and the Services Contractor (hereinafter referred to as the CONTRACTOR) and shall be promises, conditions, requirements and obligations mutually agreed upon by both parties of the Contract.

1. LAW

This CONTRACT is subject to and shall be interpreted under the law of the State of Nebraska and the directions as set forth in the BUILDING COMMISSION'S resolutions and policies. In this instance, the Building Commission is requesting proposals and will evaluate and consider the proposals received, but is not required to tender the contract to the lowest and best proposal. Court Jurisdiction shall exclusively be in the District Court for Douglas County. The CONTRACTOR shall insure that the CONTRACTOR and the CONTRACTOR'S employees, agents, and officers are familiar with, and comply with, applicable Federal, State, and Local laws and regulations as now written or hereafter amended.

2. RELATIONSHIP OF CONTRACTOR AND BUILDING COMMISSION

The relationship of the CONTRACTOR to the BUILDING COMMISSION shall be that of an independent Contractor and the CONTRACTOR shall have entire charge, control, and supervision of the work. The CONTRACTOR may furnish as many people as, in its opinion, shall be necessary to perform the services specified by the Contract within the time frame allotted, unless specified numbers of personnel are stipulated in the associated Exhibit(s). The CONTRACTOR shall have the sole right to hire or fire any of its employees at its discretion. The BUILDING COMMISSION reserves the right to request that the CONTRACTOR remove an individual employee of the CONTRACTOR'S from the Contract for reasons of unsatisfactory performance or conflict of interest with the objectives of this Contract or any Building Commission Personnel or the general public. The CONTRACTOR shall provide trained, qualified personnel working under responsible supervision to perform the specified services.

In the performance of the CONTRACTOR'S obligations under this CONTRACT, it is understood, acknowledged and agreed between the parties that the CONTRACTOR is at all times acting and performing as an Independent Contractor, and the BUILDING COMMISSION shall neither have nor exercise any control or direction over the manner and means by which the CONTRACTOR performs the CONTRACTOR'S obligations under this CONTRACT, except as otherwise stated within the CONTRACT terms.

The CONTRACTOR understands and agrees that the CONTRACTOR and the CONTRACTOR'S employees, agents, servants, or other personnel are not BUILDING COMMISSION employees. The CONTRACTOR shall be solely responsible for payment of salaries, wages, payroll taxes, unemployment benefits or any other form of compensation or benefit to the CONTRACTOR or any of the CONTRACTOR'S employees, agents, servants or other personnel performing services or work under this CONTRACT, whether it be of a direct or indirect nature. Further in that regard, it is expressly understood and agreed that for such purposes neither the CONTRACTOR nor the CONTRACTOR'S employees, agents, servants or other personnel shall be entitled to any BUILDING COMMISSION payroll, insurance, unemployment, worker's compensation, retirement or any other benefits whatsoever.

3. NON-DISCRIMINATION

CONTRACTOR will not discriminate against any employee or applicant for employment because of race, color, sex, national origin, religion, age, handicap or veteran status. CONTRACTOR will, where appropriate or required, take affirmative action to ensure that applicants are employed, and that employees are treated, during employment, without regard to their race, color, sex, or national origin. CONTRACTOR will cooperate with the BUILDING COMMISSION in using CONTRACTOR'S best efforts to ensure that Disadvantaged Business Enterprises are afforded the maximum opportunity to compete for subcontracts or work under this agreement.

4. COMPLIANCE WITH IMMIGRATION AND CONTROL ACT

CONTRACTOR certifies that CONTRACTOR has complied with the United States Immigration and Control Act of 1986. All persons employed by CONTRACTOR for performance of this agreement have completed and signed Form I-9 verifying their identities and authorization for employment.

5. HOLD HARMLESS

CONTRACTOR shall indemnify, defend, and hold harmless the OMAHA DOUGLAS PUBLIC BUILDING COMMISSION, THE CITY OF OMAHA, AND DOUGLAS COUNTY, their officers, agents, and employees from and against any and all loss, damage, injuries, claims, cause or causes of action, or any liability of any kind whatsoever resulting from, or arising out of, or in connection with the services/work or equipment/materials provided by CONTRACTOR pursuant to this agreement.

6. SURETY

Bid Bond

A bid bond, certified check, or cashier's check in the amount of 5% of the base bid must accompany the bid. Failure to do so will result in a "No Bid" situation. Bids without a bid bond will not be read at the public opening.

Performance and Payment Bond

The CONTRACTOR shall, for the total dollar amount, upon execution of the Contract, furnish a good and sufficient surety in the form of a Performance and Payment Bond, Letter of Credit, Cashier's Check or other form acceptable to the BUILDING COMMISSION. If, at any time during the term of the Contract, a surety on the CONTRACTOR'S bond becomes irresponsible, the BUILDING COMMISSION shall have the right to require additional and sufficient sureties which the CONTRACTOR shall furnish within ten (10) calendar days after receiving written notice to do so. Failure to furnish said sureties within the specified time will result in the immediate termination of the Contract. NOTE: The Performance and Payment Bond Form provided will be used.

7. INSURANCE SPECIFICATION

It is the policy of **Omaha Douglas Public Building Commission** that all contractors provide a valid Certificate of Insurance indicating the following insurance requirements have been met:

General Liability which shall be no less comprehensive and no more restrictive than coverage provided by a standard form Commercial General Liability Policy (ISO CG0001) with minimum limits shown below covering bodily injury, property damage and personal injury.

Limits of at least:

$1,000,000 Per Occurrence
$2,000,000 General Aggregate
$2,000,000 Completed Operations Aggregate
$1,000,000 Personal and Advertising Injury
$ 50,000 Fire Damage Limit (any one fire)
$ 5,000 Medical Damage Limit (any one person)

-
- Coverage shall be provided by a standard form Commercial General Liability Policy covering bodily injury, property damage including loss of use, and personal injury.
- Coverage for all premises and operations and General Aggregate to apply on a Per Project Basis
- **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be named as Additional Insured on a primary and non-contributory basis including completed operations. Additional Insured status shall be maintained for Four (4) years after final acceptance and payment.
- Contractor agrees to waive its rights of recovery against **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County**. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy.
- Contractual liability coverage shall be on a broad form basis and shall not be amended by any limiting endorsements.
- If work is being done near a railroad track, the 50' railroad right of way exclusion must be deleted.
- Completed Operations shall provide coverage for work performed by contractors.
- Products and completed operations shall be maintained for duration of work, and shall be further maintained for a minimum period of four (4) years after final acceptance and payment.
- Coverage for demolition of any building or structure, collapse, explosion, blasting, excavation and damage to property below surface of ground (XCU coverage)

- Policy shall not contain a total or absolute pollution exclusion. Coverage shall be provided for pollution exposures arising from products and completed operations. (As per standard CG0001 Pollution Exclusion or equivalent.)

Automobile Liability –

Limits of at least: $1,000,000 CSL Per Accident

- Coverage shall apply to all Owned, Hired, and Non-Owned Autos.
- Contractor agrees to waive its rights of recovery against **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County**. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy.
- If work is being done near a railroad track, the 50' railroad right of way exclusion must be deleted.

Workers Compensation –

Limits: Statutory coverage for the state where the project is located.

Employers Liability limits: $500,000 Each Accident
$500,000 Disease – Per Person
$500,000 Disease – Policy Limit

- Contractor agrees to waive its rights of recovery against Contractor. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy

Umbrella / Excess –

Limits of at least: $5,000,000 Per Occurrence

- Policy shall provide liability coverage in excess of the specified Workers Compensation/Employers Liability, Commercial General Liability and Auto Liability
- Contractor agrees to waive its rights of recovery against **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County**. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy

Evidence of such insurance coverage in effect shall be provided to **Omaha Douglas Public Building Commission** in the form of an Accord certificate of insurance executed by a licensed representative of the participating insurer(s), and must contain a clause granting at least 30 days prior written notice to **Omaha Douglas Public Building Commission** of intent to affect cancellation.

8. SCHEDULES OF WORK

The CONTRACTOR shall furnish to the BUILDING COMMISSION Representative, within fifteen (15) days of Notice to Proceed, a detailed Critical Path Schedule using the Fast Track Schedule by AEC showing how the CONTRACTOR will accomplish the requirements of this Contract. Said schedule shall be kept current throughout the duration of the Contract and be modified and resubmitted to the BUILDING COMMISSION as necessary. Any work to be performed contrary to this schedule, either in task content or time, shall be approved by the BUILDING COMMISSION Representative prior to such an occurrence. A bi-weekly report of periodic tasks shall be turned into the BUILDING COMMISSION Representative by the CONTRACTOR. The Construction Contractor shall coordinate the schedule with the Owner, Contractor and all Subcontractors.

9. SECURITY

The CONTRACTOR shall obtain security badges and keys necessary to provide the access to areas to be serviced from the BUILDING COMMISSION Representative or other designated person.

The CONTRACTOR shall properly secure all areas as directed by the BUILDING COMMISSION Representative.

Each employee shall carry an identification card issued by the Building Commission to be worn in a visible location on their person at all times while performing services on the premises.

10. EQUIPMENT, MATERIALS, AND SUPPLIES

The CONTRACTOR shall furnish all necessary equipment, materials, and supplies required in performing services of the Contract. The CONTRACTOR shall use prudent care in handling, storing, and using equipment, materials and supplies. The CONTRACTOR shall be responsible for damage to property owned by the BUILDING COMMISSION.

Items furnished by the BUILDING COMMISSION shall be used ONLY for areas designated by the Contract or as directed by the BUILDING COMMISSION Representative. The CONTRACTOR shall submit, within ten (10) days before contract start date, manufacturers' technical literature, specifications, and Material Safety Data sheets to the BUILDING COMMISSION for all materials and supplies to be used in conjunction with the Contract. The BUILDING COMMISSION reserves the right to approve or disapprove the use of any said materials and supplies.

11. ADJUSTMENT OF SERVICES

The BUILDING COMMISSION reserves the right to eliminate, reduce, or otherwise adjust the scope of services provided by the CONTRACTOR and as defined in the Exhibits of the Contract with the appropriate adjustment in dollars paid to the Contractor.

12. TERM OF CONTRACT

The Contract shall commence on the effective date annotated on the "Contract" issued by the BUILDING COMMISSION. Notice to Proceed will be effective on the date the contract is signed. The CONTRACTOR shall have five (5) working days to sign the contract after Notice of Award or the bid bond will be forfeited.

13. QUOTATION

The BUILDING COMMISSION will purchase services of the Contract from the CONTRACTOR as set forth herein and defined in attached Exhibits for the dollar amount so indicated on the attached "Contract."

14. TERMINATION OF CONTRACT

In the event of bankruptcy or insolvency of the CONTRACTOR, or in the event of violation of any of the terms of these conditions, or in the event that the BUILDING COMMISSION in its sole discretion determines that the CONTRACTOR is not performing its duties in a proper or quality manner or in the event a continuing pattern of violations are committed, regardless if cured in the proper manner, the BUILDING COMMISSION may, upon ten (10) days written notice, declare the Contract terminated. The Bonding Company shall be notified to take over the remaining time of the Contract. In the event any violation is corrected by the CONTRACTOR to the sole satisfaction of the BUILDING COMMISSION within five (5) days from receipt of said notice, the Contract may not be terminated. Failure to terminate the Contract by the BUILDING COMMISSION shall not be a waiver of the right of the BUILDING COMMISSION to terminate the Contract in the event of subsequent violations. Should the BUILDING COMMISSION terminate a contract or purchase order with any CONTRACTOR because of any default by said CONTRACTOR, the CONTRACTOR involved may be removed from the BUILDING COMMISSION'S Bidders List for a period of twelve (12) months from the date of termination. Said CONTRACTOR shall not be allowed to bid on contracts for the BUILDING COMMISSION during this period.

The BUILDING COMMISSION may terminate this contract without cause, in whole or in part, when it is in the best interest of the BUILDING COMMISSION, upon thirty (30) days written notice to the CONTRACTOR. If the Contract is terminated, the BUILDING COMMISSION shall be liable only for payment for services rendered before the effective date of termination.

15. VERBAL AGREEMENTS

No verbal agreements or conversations with any officer, agent, or employee of the BUILDING COMMISSION shall change or modify any of the terms or obligations contained in any of the documents comprising the Contract.

16. ASSIGNMENT OF CONTRACT

This Contract shall not be assigned in whole or in part by the CONTRACTOR without prior written consent of the BUILDING COMMISSION.

17. TAXES

The BUILDING COMMISSION will provide the CONTRACTOR with a State of Nebraska Department of Revenue Resale or Exempt Sale Certificate, Form 13, for exemption of applicable taxes for labor, materials, and supplies pertaining to the Contract.

18. NOTICE

Any notice to the parties required under this agreement shall be in writing delivered to the person designated as BUILDING COMMISSION Representative at the indicated address unless otherwise designated in writing. Only postage by United States mail or in-hand delivery shall be utilized.

Proposers are cautioned to refrain from contacting or soliciting any Building Commission elected or appointed officials regarding this RFP. Unauthorized contact will result in immediate disqualification.

19. BILLING AND PAYMENTS

The CONTRACTOR shall submit an invoice to the BUILDING COMMISSION by the 25th of each calendar month for work provided during the preceding month. The BUILDING COMMISSION will render payment on all invoices received within 30 days of receipt of the invoice. Disputed claims will be negotiated by the CONTRACTOR and the BUILDING COMMISSION Representative and resolved prior to approval of the invoice by the BUILDING COMMISSION for payment. A retainage of 10% will be withheld from all invoices. Use AIA Form G703 to submit payment requests.

20. COMPLIANCE

In the conduct of the work or the supplies, equipment or materials contemplated hereunder, the CONTRACTOR shall comply with all applicable state, federal, and local law, rules and regulations, technical standards or specifications issued by the BUILDING COMMISSION. CONTRACTOR must qualify for and obtain any required licenses prior to commencement of work.

21. CONDUCT

All employees, representatives, and officials of the CONTRACTOR shall be expected to maintain favorable relations with the public, and BUILDING COMMISSION officers and employees, by practicing courtesy in all contacts. Any display of offensive, discourteous or rude behavior toward BUILDING COMMISSION officers, employees, or members of the public, by the CONTRACTOR, subcontractor, or any of their employees or representatives, may be cause for contract cancellation.

Alcoholic beverages are prohibited. Contract personnel are not to show up for work under the influence or in any other condition which will detract from the performance of their duties. Use of any form of drug or narcotic on duty or being under their influence when appearing for duty is prohibited.

Smoking in the complex will be permitted in designated smoking areas only. There shall be no smoking in or around the construction area.

22. SAFEGUARDING BUILDING COMMISSION PROPERTY

The Contractor shall take all reasonable precautions to safeguard and protect Building Commission property. In the event there is loss, theft or damage reported to the Building Commission’s Representative, and there is reasonable cause to believe contract personnel may have been involved, the Building Commission may require POLYGRAPH TESTS for those so implicated, the tests are to be administered by a Polygraphist that has been approved by the Security Administrator. All cost for such tests are the sole responsibility of the Contractor.

23. FEDERAL STANDARDS

Contractor shall comply with OSHA Enforcement Procedures for Occupational Exposure to Blood borne Pathogens Standard 29 CFR 1910.1030. CONTRACTOR shall furnish to the BUILDING COMMISSION within the first fifteen (15) working days of the Contract an Exposure Control Plan.

CONTRACTOR shall provide to the BUILDING COMMISSION copies of Material Safety Data Sheets on all chemicals.

The CONTRACTOR falls under Federal OSHA regulations while performing duties on City, County, and Building Commission property. The CONTRACTOR is responsible for full OSHA compliance. Any fine levied against the BUILDING COMMISSION because of actions or the lack of actions under the CONTRACTOR'S control will be deducted from any payment due the CONTRACTOR by the BUILDING COMMISSION.

24. CHANGES AND MODIFICATIONS TO THESE GENERAL CONDITIONS

Any and all changes or modifications to be made to the General Conditions shall be done by creation of documents titled "Supplemental Conditions of the Contract, which shall reference the affected paragraph of this document and clearly state the changes or modifications thereto. Said "Supplemental Conditions" shall become a part of the documents comprising the Contract.

SAMPLE OF

CONTRACT AGREEMENT

AGREEMENT

This Agreement, made _____(date), by and between Omaha Douglas Public Building Commission, 1819 Farnam Street, Suite 1205, Omaha (hereinafter referred to as "Owner") and _____, _____Street, Omaha, NE _____, Phone _____ (hereinafter referred to as "Contractor").

W I T N E S S E T H:

WHEREAS, the Owner is responsible for the care and maintenance of the Civic Center and Hall of Justice, including the ramps accessing the underground garage facility and the underground garage;

WHEREAS, Owner determined the need to repair, replace, and reconstruct the Civic Center and Hall of Justice _____;

WHEREAS, Owner requested bids for construction of the Civic Center and the Hall of Justice _____Project with _____ alternates;

WHEREAS, Contractor submitted a bid to complete the work described in the bid documents, and the four alternates;

WHEREAS, Owner and Contractor desire to enter into this Agreement to provide for Contractor to complete this work;

NOW, THEREFORE, for and in consideration of the mutual covenants and agreements herein contained, the parties do hereby mutually undertake, promise, agree and contract each for itself and its successors and assigns as follows:

Section 1. Contractor agrees to furnish all labor, material and equipment, necessary to perform and complete all the work for the Civic Center and Hall of Justice _____ Project, Project #_____, as described in Scope of Work below, including instructions to Bidders and the specifications, and in accordance with the drawings and all other documents, including addendum #___ through #____, which are a part of the contract between Contractor and Owner (hereinafter referred to collectively as "Contract Documents"). Contractor shall be bound to the Owner by the Contract Documents and shall accept the same obligations and responsibilities in the performance of this contract that the Contractor accepts with the Owner. In case of conflict between the Contract Documents and this Agreement, this Agreement shall govern.

Section 2. Scope of Work: The Contractor agrees to promptly begin said work after notification by Owner and complete all work as follows in accordance with this Agreement:

_____

_____

INCLUDING ALTERNATES __, , AND , LOCATED AT THE OMAHA DOUGLAS CIVIC CENTER/HALL OF JUSTICE COMPLEX, 1819 FARNAM STREET, OMAHA, DOUGLAS COUNTY, NEBRASKA, IN ACCORDANCE WITH ALL INSTRUCTIONS TO BIDDERS, GENERAL CONDITIONS, SPECIFICATIONS, DRAWINGS AND PLANS, INCLUDING ADDENDUM #___ THROUGH ADDENDUM #___.

Changes to scope of work shall be in writing between Owner and Contractor and no additional monies will be allowed to Contractor without prior approval by Owner's project manager.

Section 3. Payment Terms: Owner agrees to pay Contractor for satisfactory performance of Contractor's work the sum of _____ Dollars and no/100 ($_____), as outlined in the bid proposal and broken out as follows:

Contract Base Bid Price	$_____
Alternate #1 –	_____
Alternate #2 –	_____
Total	$_____

Said amount to be paid as follows: Contractor will invoice the owner on the 25th of each month. Invoices submitted and approved prior to that date will be paid within 30 days after Owner invoice date. Requests for payments should be submitted on AIA Document G702, Application and Certificate for Payment. Retainage in the amount of 10% will be held on all invoices. Final retainage will be paid upon receipt of a retainage invoice, all required close out documentation and final acceptance of the work. Requests for payments should be presented for certification to the HDR Architecture Inc., the Building Commission's Architectural and Engineering consultant for this project.

Set out below is Contractor's list of his Suppliers. This list must be submitted in detail before Contractor's invoice will be processed. Any suppliers/subcontractors furnishing materials or services in amounts totaling greater than $ 500 must be listed below.

Name	Address	Phone

Section 4. It is contemplated that Contractor will complete all work outlined in the Agreement in _____calendar days from receiving a Notice to Proceed from Owner, except as modified by mutual agreement of the parties consistent with Section 9 of this Agreement. The incentives and penalties for Contractor to perform within the terms of this Agreement are outlined in Section 9.

Section 5. Insurance It is the policy of Omaha Douglas Public Building Commission that all contractors provide a valid Certificate of Insurance indicating the following insurance requirements have been met:

General Liability which shall be no less comprehensive and no more restrictive than coverage provided by a standard form Commercial General Liability Policy (ISO CG0001) with minimum limits shown below covering bodily injury, property damage and personal injury.

Limits of at least:

$1,000,000 Per Occurrence
$2,000,000 General Aggregate
$2,000,000 Completed Operations Aggregate
$1,000,000 Personal and Advertising Injury
$ 50,000 Fire Damage Limit (any one fire)
$ 5,000 Medical Damage Limit (any one person)

- Coverage shall be provided by a standard form Commercial General Liability Policy covering bodily injury, property damage including loss of use, and personal injury.
- Coverage for all premises and operations and General Aggregate to apply on a Per Project Basis
- **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be named as Additional Insureds on a primary and non-contributory basis including completed operations. Additional Insured status shall be maintained for Four (4) years after final acceptance and payment.
- Contractor agrees to waive its rights of recovery against **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County**. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy.
- Contractual liability coverage shall be on a broad form basis and shall not be amended by any limiting endorsements.
- If work is being done near a railroad track, the 50' railroad right of way exclusion must be deleted.
- Completed Operations shall provide coverage for work performed by contractors.
- Products and completed operations shall be maintained for duration of work, and shall be further maintained for a minimum period of four (4) years after final acceptance and payment.
- Coverage for demolition of any building or structure, collapse, explosion, blasting, excavation and damage to property below surface of ground (XCU coverage)
- Policy shall not contain a total or absolute pollution exclusion. Coverage shall be provided for pollution exposures arising from products and completed operations. (As per standard CG0001 Pollution Exclusion or equivalent.)

Automobile Liability –

Limits of at least: $1,000,000 CSL Per Accident

- Coverage shall apply to all Owned, Hired, and Non-Owned Autos.
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Workers Compensation –

Limits: Statutory coverage for the state where the project is located.

Employers Liability limits: $500,000 Each Accident
$500,000 Disease – Per Person
$500,000 Disease – Policy Limit

- Contractor agrees to waive its rights of recovery against Contractor. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy

Umbrella / Excess –

Limits of at least: $5,000,000 Per Occurrence

- Policy shall provide liability coverage in excess of the specified Workers Compensation/Employers Liability, Commercial General Liability and Auto Liability
- Contractor agrees to waive its rights of recovery against **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County**. Waiver of Subrogation in favor of **Omaha Douglas Public Building Commission, City of Omaha, & Douglas County** shall be added to the policy

Evidence of such insurance coverage in effect shall be provided to **Omaha Douglas Public Building Commission** in the form of an Accord certificate of insurance executed by a licensed representative of the participating insurer(s), and must contain a clause granting at least 30 days prior written notice to **Omaha Douglas Public Building Commission** of intent to affect cancellation.

Section 6. Contractor shall pay for all state and/or federal taxes, assessments, Unemployment Compensation Contributions or other charges and acquire and pay for necessary permits and/or licenses to do business as required by law. Contractor is responsible for all procedures required by local code and cost of same is included in the amount of this contract agreement. Materials purchased for this job are tax-exempt.

Section 7. Contractor agrees to observe and comply with all applicable federal, state and local laws, ordinances, rules and regulations, including but not limited to the Occupational Safety and Health Act of 1970 and Standard 1926.59 Written Hazard Communication Program. Any OSHA fines levied against the Owner resulting from Contractor's violations of OSHA standards will be deducted from payment for work performed. Contractor shall maintain a safe working environment on the job at all times.

Section 8. Contractor is required and hereby agrees to use a federal immigration verification system to determine the work eligibility status of new employees physically performing services within the State of Nebraska. A federal immigration verification system means the electronic verification of the work authorization program authorized by the Illegal Immigration Reform and Immigrant Responsibility Act of 1996, 8 U.S.C. 1324a, known as the E-Verify Program, or an equivalent federal program designated by the United States Department of Homeland Security or other federal agency authorized to verify the work eligibility status of a newly hired employee.

If the Contractor is an individual or sole proprietorship, the following applies:

1 The Contractor must complete the United States Citizenship Attestation Form, available on the Department of Administrative Services website at www.das.state.ne.us.

2 If the Contractor indicates on such attestation form that he or she is a qualified alien, the Contractor agrees to provide the US Citizenship and Immigration Services documentation required to verify the Contractor's lawful presence in the United States using the Systematic Alien Verification for Entitlements (SAVE) Program.

3 The Contractor understands and agrees that lawful presence in the United States is required and the Contractor may be disqualified or the contract terminated if such lawful presence cannot be verified as required by Neb. Rev. Stat. §4-108.

Section 9. All work to be performed pursuant to this contract shall be in a workmanlike manner to the full satisfaction of the Owner in accordance with plans and specifications. Time is of the essence and the Contractor shall at all times have a sufficient number of skilled workmen, materials and equipment at the project to adequately perform the work to not delay the progress or completion of the work or any portion thereof. Owner shall be the sole judge on whether or not a trade is delaying the project progress. Contractor shall be liable for all direct, indirect, consequential and special damages suffered by Owner. If Contractor fails to complete scope of work according to Owner's construction schedule, or any revision thereof, fails to begin or complete said work or portion thereof within the time period specified, which is _____calendar days from Notice to Proceed, or perform scope of work per specifications with diligence and sufficient labor, materials, equipment and services to maintain the progress through to completion, liquidated damages in the amount of _____ and no/100 Dollars ($ _____) per day shall be assessed for delays due to nonperformance or failure to meet the schedule. If the contractor completes the project prior to _____ calendar days from Notice to Proceed, the contractor will receive from the Omaha Douglas Public Building Commission the amount of _____ and no/100 Dollars ($_____) per day prior to the aforementioned number of calendar days for completion up to a maximum total of _____ and no/100 Dollars ($_____).

Section 10. Contractor shall furnish, execute and deliver, in accordance with Section 52-118 R.R.S. 1943, a cash deposit or performance, payment and maintenance bond, subject to approval as to form by the Building Commission's Attorney, to the Owner, with a surety company authorized to do business in the State of Nebraska as a surety, in an amount equal to the anticipated cost to perform this contract, with the initiation of construction. Such bond shall be maintained in full force and effect throughout the construction period and be conditioned upon the faithful performance of all conditions and covenants relating to construction contained in this Agreement. The final three-percent (3%) of such bond shall not be released without the approval of the Commissioner of the Nebraska Department of Labor.

Section 11. Owner has the right to terminate contract agreement for default after 24 hours written notice in the event of Contractor's failure to perform its obligations under this agreement. In this event, Contractor will be responsible for the cost to complete the work described in Section 2. Owner has the right to terminate this Agreement for convenience. In the event of termination for convenience of Owner, contractor shall be entitled to equitable settlement of the contract excluding consequential damages or anticipated profit. If contract agreement is terminated for default and later determined not to be default, the termination shall be considered for convenience.

Section 12. Owner's failure to require strict compliance with the contract on one event does not constitute a waiver of the right to require strict compliance in later events.

Section 13. This agreement shall be governed in accordance with the laws of the State of Nebraska applicable to agreements to be performed in such state, provided that all rights pertaining to mechanic's liens shall be governed by the state where the project is located. In the event it is necessary for Owner to initiate an action against Contractor in order to enforce the terms of this contract or to interpret the rights and obligations of the parties hereunder, the prevailing party shall be entitled to all costs incurred in connection therewith including attorney's fees.

Section 14. Owner shall be permitted to retain from any contract consideration due or to become due to contractor, an amount sufficient to satisfy all delinquent obligations of contractor for labor, materials, equipment/services, etc.

Section 15. This contract shall not be assigned or sublet by the Contractor without first obtaining permission in writing from the Owner. The Contractor shall be responsible for performance of work by his employees, agents or his Subcontractors, and the Contractor agrees to bind Subcontractors to all provisions of this Agreement.

Section 16. Punch list items are to be completed within two days of Contractor being notified by the Owner or Contractor's work will be finished by others, of Owner's choice, and the cost will be deducted from retainage due. If the nature of the work does not allow it to be completed within two days, Contractor shall be permitted a reasonable period of time to complete the work, with Owner's consent, to complete such punch list items. Contractor is to be responsible for his own daily clean up or it will be done by others and backcharged accordingly.

Section 17. Contractor agrees to hold harmless and indemnify the Owner and its agents from any and all claims, disputes, liens, lawsuits, injuries or damages resulting from, but not necessarily limited to, negligence, use of improper or defective materials, poor workmanship or any acts of commission or omission or action of any kind which may be brought against the Owner and their agents or property.

Section 18. This agreement constitutes the entire agreement between the parties relating to the Work covered hereby and no other agreement, representation or understanding concerning the same has been made.

This agreement supersedes all prior negotiations, proposals, and agreements and no oral statement, understanding or agreement shall effect the terms hereof.

Section 19. GENERAL PROVISIONS

Assignment – No assignment of this Agreement, or of any rights there under, by any party, shall be valid without the written consent of the other parties.

Non-Discrimination – The parties hereto shall not, in the performance of this Agreement, discriminate or permit discrimination in violation of federal or state laws or local ordinances because of race, color, sex, age, disability, political or religious opinions, affiliations or national origin.

Captions – Captions used in this Agreement are for convenience and are not used in the construction of this Agreement.

Applicable Law – Parties to this Agreement shall conform with all existing and applicable City ordinances, resolutions, state laws, federal laws, and all existing and applicable rules and regulations. Nebraska law will govern the terms and the performance under this Agreement.

Interest of the Parties – The parties hereto covenant that they presently have no interests and shall not acquire any interests, direct or indirect, which would conflict with the performance of services required to be performed under this Agreement; they further covenant that in the performance of this Agreement, no person having any such interests shall be employed.

Merger – This Agreement shall not be merged into any other oral or written Agreement, lease or deed of any type. This is the complete and full agreement of the parties.

Modification – This Agreement contains the entire agreement of the parties. No representations were made or relied upon by any party other than those that are expressly set forth herein. No agent, employee or other representative of any party is empowered to alter any of the terms hereof unless done in writing and signed by an authorized officer of the respective parties.

Strict Compliance – All provisions of this Agreement and each and every document that shall be attached shall be strictly complied with as written, and no substitution or change shall be made except upon written direction from authorized representative

Section 20. AUTHORIZED REPRESENTATIVE

In further consideration of the mutual covenants herein contained, the parties hereto expressly agree that for purposes of notice, including legal service or process, during the term of this agreement the following named individuals shall be authorized representatives of the parties:

A. Omaha/Douglas Public Building Commission
Attn: Administrator
1819 Farnam Street, Suite 1205
Omaha, NE 68183
Telephone: (402) 444-5345

B. _____
Attn: _____
_____
Omaha, NE 681__,
Telephone (___)_____

This agreement entered into as of the day and year first written above.

Omaha Douglas Public Building Commission, Owner

BY: _____
Paul G. Cohen
TITLE: Building Commission Administrator
DATE: _____

_____, Contractor

BY: _____
_____ (Printed name)
TITLE: _____
DATE: _____

by:_____
Building Commission Attorney at Law

DIVISION 00

PROCUREMENT AND CONTRACTING REQUIREMENTS

SECTION 00 11 13
ADVERTISEMENT TO BID

PART 1 - GENERAL

1.1 INVITATION

A. Owner invites sealed Bids for Single-Prime Contract on general construction work to include work of all trades.
   1. Project Title: Courthouse Renovation Project in the Hall of Justice Complex.
   2. Project Address: 1701 Farnam St. Omaha, NE 68183.
   3. Owner Name: Omaha Douglas Public Building Commission.
   4. Architect: HDR Architecture, Inc.
   5. Bids shall be lump sum basis for general construction work to include work of all trades.
      a. Segregated bids will not be accepted.

1.2 DESCRIPTION

A. Description: The Douglas County Courthouse renovation will consist of Architectural, Structural, Mechanical, Electrical and Interior design. This project is for a renovation to a portion of the 6th, 3rd and 2nd level of the Douglas County Courthouse. The following areas are being renovated:

B. 1st FLOOR: ceiling modifications to install HVAC.

C. 2nd FLOOR:
   1. West wing - 12,056sf remodeling.
   2. East wing – 12,790sf remodeling

D. 3rd FLOOR:
   1. 5,225sf remodeling (Courtroom #30 is not being remodeled)
   2. Adding Probate area -2,307 sf remodeling

E. 4th FLOOR:
   1.

F. 6th FLOOR: 7,371sf remodeling. Adding new ramp and waiting area – 481sf

1.3 OWNER PROJECT NUMBER

A. Owners Project Number: 14043.

1.4 COMPLETION

A. Completion of this work in timely manner is of the essence.

1.5 BIDS RECEIVING AND OPENING

A. Sealed Bid Receiving:
   1. Bid Receiving Date and Time: July 27th 2015, 10:00 A.M. Local Time.
   2. Bid Receiving Location: Office of the Admnistrator, Omaha- Douglas Civic Center, by one of following methods:
   3. Hand-Carry Delivery: Office of the Administrator
      Omaha -Douglas Civic Center
      Suite 1205
      1819 Farnam St.
      Omaha, Ne 68183
      a. Add exact mailing address of Owner where bids may be mailed

4. Mailing Address: Office of the Administrator
Omaha- Douglas Civic Center
Suite 1205
1819 Farnam St.
Omaha, Ne 68183
   a. Verify with Owner how and where mail is delivered to facility or campus and how much time should be allocated for delivery of Bids within facility or on campus. Add following statement so bidders are aware; however, bidders are ultimately responsible for timely delivery of their bid.
   b. Bids sent by mail: Allow at least 2 days for inter-campus mail delivery.
5. Bids are valid only if deposited at designated receiving location prior to receiving time.
6. All bids shall be registered by automatic time clock at time of deposit.
7. Bids deposited after receiving time will be returned unopened.

B. Sealed Bid Opening:
1. Opening Location: Office of the Administrator
Omaha- Douglas Civic Center
Suite 1205
1819 Farnam St.
Omaha, Ne 68183
2. Opening Time: Bid opening shall be approximately 15 minutes after "receiving time".
   a. Valid bids will be publicly opened in opening location indicated, and read aloud.

1.6 EXAMINATION OF BID DOCUMENTS

A. Bidding Documents may be viewed at office of:

1. Office of the Administrator:
Omaha- Douglas Civic Center
Suite 1205
1819 Farnam St.
Omaha, Ne 68183
   a. All costs for obtaining the information for bidding are the responsibility of the bidder.

2. Plan Distribution Service Provider (PDSP): Standard Digital Imaging

   a. Documents are available to view at: www.standardshare.com
      1. Once you have navigated to StandardSHARE.com – click on the Planroom: The project will be listed by the project name. Hardcopy prints and PDF downloads are available through StandardSHARE.
      2. All costs for obtaining the information for bidding are the responsibility of the bidder.

   b. Bidding documents are also available by contacting:
      1. Standard Digital Imaging - 4424 South 108th Street / Omaha, NE 68137 / 402-592-1292
      2. All costs for obtaining the information for bidding are the responsibility of the bidder.

1.7 OBTAINING BID DOCUMENTS – PURCHASE

A. Persons desiring bid documents may purchase them.

B. Only complete sets of Bid Documents may be obtained.
1. No refunds on purchased items.

2. Applicable sales tax will be charged.
3. Bidder is solely responsible for selection of documents and completeness of their Bid.

C. Bid Documents may be purchased from Plan Distribution Service Provider (PDSP) upon receipt of non-refundable payment in amount as determined by the PDSP, payable to PDSP.
   1. If Bid Documents are to be transmitted by mail, parcel service, FedEx, or UPS submit a separate, non-refundable payment to PDSP to cover cost of shipping and handling.
      a. Obtain cost for shipping and handling from PDSP.

1.8 BID SECURITY

A. Submit Bid Security with Bid Form in form and amount indicated in Section 00 21 13 - Instructions to Bidders.

1.9 BOND

A. Successful Bidder shall submit Owner's Protective Bond in amount of 100 percent of Contract amount.
   1. See General Conditions of the Contract for Services, Article 6 - Performance and Payment Bond.

1.10 WITHDRAWAL

A. Bids may not be withdrawn prior to 30 calendar days after actual date of opening Bids.

1.11 REJECTION OF BIDS

A. Owner reserves right to waive any informalities or to reject any or all Bids.

B. Owner further reserves right to reject any and all Bids, and to re-advertise for Bids.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 00 21 13
INSTRUCTIONS TO BIDDERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions followed by an asterisk (*) include some or all provision as obtained from AIA Document A**701-1997**.

1.2 RECEIPT AND OPENING OF BIDS

A. Omaha Douglas Public Building Commission (herein called "Owner"), invites Bids for construction.

B. For following Project:
Omaha Douglas Public Building Commission - Courthouse Renovation Project

C. Bids will be received at place and time indicated in Advertisement for Bids.

D. Bids received late will not be opened.

E. Bids will be publicly opened and read aloud.

1.3 METHOD OF BIDDING

A. Owner invites Bids on general construction work to include work of all trades.

B. See Bid Form for specific requirements regarding bids and cost breakdown.

1.4 PREPARATION OF BID

A. Submit on Bid Form included in bid documents.

B. Fill out in ink or typewritten, without erasure, interlineation or changes.

C. Make Bid in name of principal and if co-partnership, give names of all parties.

D. Give bidder's complete address.

E. For Bids submitted by an agent, provide satisfactory evidence of agency authority.

F. Delete calendar days if not required.

G. Indicate number of consecutive calendar days for construction Substantial Completion of Work.

H. Fill in bid prices in both words and figures.

I. Submit bid in sealed envelope.

J. Indicate on outside of envelope, name of bidder, bidders address, and name of Project for which bid is submitted.

K. If forwarded by mail, enclose sealed envelope containing Bid Form in another envelope addressed as indicated.

1.5 BID SECURITY

A. Each Bid shall be accompanied by a bid security in the form and amount required if so stipulated in the Instructions to Bidders.

B. Bidder pledges to enter into a Contract with Owner on the terms stated in the Bid and will, if required, furnish bonds covering the faithful performance of the Contract and payment of all obligations arising thereunder.

1. Should the Bidder refuse to enter into such Contract or fail to furnish such bonds if required, the amount of the bid security shall be forfeited to Owner as liquidated damages, not as a penalty. *

C. Submit bid with cash, certified check or bid bond, in amount of five (5) percent of highest total base bid combination, including all add Alternates.
   1. Bid bond shall be on AIA Document A310, duly executed by bidder as principal and having a surety thereon, by company authorized to issue bond. Agent signing bid bond must file with bond; certified and effectively dated copy of power of attorney showing any limitation in regard to total amount for which any single bond can be issued.

1.6 MODIFICATION OR WITHDRAWAL OF BID

A. Bid may be withdrawn or modified prior to scheduled time for opening, under following terms:
   1. Bidder may, without prejudice to self, withdraw bid after it has been deposited, provided request for such withdrawal is received in writing or by telegram, before time set for opening.
   2. Telephonic communications not acceptable.
   3. Bidder may modify bid by telegraphic communication at any time prior to scheduled time for opening, provided such telegraphic communication is received prior to opening, and, provided further, Owner is satisfied that written confirmation signed by bidder was mailed prior to opening.
      a. Do not reveal bid price in telegraphic communication.
      b. No consideration will be given by telegraphic communication if written confirmation is not received within two (2) days after scheduled time for opening.

B. After opening, no bid may be withdrawn or modified for period indicated in Bid Form.

C. Provide addition, subtraction or modification so that final prices or terms will not be known until sealed Bid Form is opened.

1.7 INTERPRETATIONS

A. Bidder shall carefully study and compare Bidding Documents with each other, and with other work being bid concurrently or presently under construction to the extent that it relates to the Work for which Bid is submitted, shall examine site and local conditions for errors, inconsistencies or ambiguities discovered. *

B. In event of errors, inconsistencies or ambiguities discovered between portions of Bidding Documents or within Bidding Documents or bidder is in doubt of meaning of any part of Biding Documents, bring to Architect's attention by, submitting Bid Document Request For Interpretation:
   1. Use attached form to address on form.
      a. Bidder submitting request is responsible for prompt delivery of such requests.
      b. Request must be received AT LEAST 15 DAYS PRIOR to date fixed for opening of bids.
   2. Interpretations, corrections and changes of Bidding Documents will be made by Addendum. Interpretations, corrections and changes of the Bidding Documents made in any other manner will not be binding, and Bidders shall not rely upon them. *
      a. Copy of such Addendum will be will be made available for inspection wherever Bidding Documents are on file for that purpose, and will be transmitted to all who are known by the issuer to have received a complete set of Bidding Documents, prior to date fixed for opening of bids.
      b. Failure to receive such Addendum does not relieve bidder from any obligation under bid as submitted.
      c. All Addenda become part of Bidding Documents and Contract Documents.
      d. Each Bidder shall ascertain prior to submitting a Bid that Bidder has received all Addenda issued, and Bidder shall acknowledge their receipt on Bid Form.

C. Oral interpretations will not be binding.

D. Owner or Architect is not responsible for any other explanations or interpretations which anyone presumes to make.

E. Bidder desiring approval of material or equipment not specified must comply with Section 00 26 00.

1.8 CONTINGENCY ALLOWANCE

A. Base Bid must include Contingency Allowance.

1.9 IRREGULAR BID AND REJECTION OF BIDS

A. Bid is considered irregular and may be rejected for following reasons unless otherwise provided by law:
   1. If Bid Form furnished is not used or is altered.
   2. If there are unauthorized additions, conditional bids, or irregularities of any kind which may tend to make bid incomplete, indefinite, or ambiguous.
   3. If bidder adds any provisions reserving right to accept or reject any award, or to enter into contract pursuant to an award.
   4. If unit or lump sum prices contained in bid schedule are obviously unbalanced either in excess of, or below, reasonable cost analysis values.
   5. If bidder fails to complete Bid Form where information is requested, so bid may be properly evaluated.

B. Owner reserves right to reject any or all bids and to waive irregularities or informalities as may be in Owner’s interest.

1.10 ACCEPTANCE OF BID (AWARD)

A. It is intent of Owner to award a Contract to lowest qualified Bidder provided Bid has been submitted in accordance with requirements of Bidding Documents and does not exceed funds available. *

B. If Base Bid exceeds such amount, Owner may reject all bids.

C. Owner may award contract based on time to obtain Substantial Completion.

D. Owner may award contract based on combination of price, time, and qualifications.

E. Owner shall have right to waive informalities and irregularities in a Bid received and to accept Bid which, in Owner's judgment, is in Owner's own best interests.

1.11 PRE-BID CONFERENCE

A. Mandatory pre-bid conference and walk thru will be held to review bidding procedures, review documents, and tour site.
   1. Location: Office of the Admnistrator
      Omaha- Douglas Civic Center
      Suite 1205
      1819 Farnam St.
      Omaha, Ne 68183
   2. Date: Saturday June 27th, 2015
   3. Time: 10:00 AM Local Time.

1.12 DEFINITIONS *

A. Bidding Documents include Bidding Requirements and proposed Contract Documents. Bidding Requirements consist of Advertisement or Invitation to Bid, Instructions to Bidders, Supplementary Instructions to Bidders, the Bid Form, and other sample bidding and contract forms. The proposed Contract Documents consist of the form of Agreement between the Owner and Contractor, Conditions of the Contract (General, Supplementary and other Conditions), Drawings, Specifications and all Addenda and clarifications issued prior to execution of Contract.

B. Definitions set forth in General Conditions of the Contract for Construction or in other Contract Documents are applicable to Bidding Documents.

C. Addenda are written or graphic instruments issued by Architect prior to execution of Contract which modify or interpret Bidding Documents by additions, deletions, clarifications or corrections.

D. A Bid is a complete and properly executed proposal to do the Work for sums stipulated therein, submitted in accordance with Bidding Documents.

E. The Base Bid is the sum stated in the Bid for which Bidder offers to perform the Work described in Bidding Documents as the base, to which Work may be added or from which Work may be deleted for sums stated in Alternate Bids.

F. An Alternate Bid (Alternate Bid) is an amount stated in the Bid to be added to or deducted from the amount of Base Bid if the corresponding change in the Work, as described in the Bidding Documents, is accepted.

G. A Bid is a complete and properly executed proposal to do the Work for the sums stipulated therein, submitted in accordance with Bidding Documents.

H. A Unit Price is an amount stated in the Bid as a price per unit of measurement for materials, equipment or services or a portion of the Work as described in Bidding Documents.

I. A Bidder is a person or entity who submits a Bid and who meets the requirements set forth in Bidding Documents.

J. A Sub-bidder is a person or entity who submits a bid to a Bidder for materials, equipment or labor for a portion of the Work.

1.13 BIDDER'S REPRESENTATIONS *

A. Bidder by making a Bid represents that:
   1. Bidder has read and understands the Bidding Documents or Contract Documents, to the extent that such documentation relates to the Work for which Bid is submitted, and for other portions of the Project, if any, being bid concurrently or presently under construction.
   2. Bid is made in compliance with Bidding Documents.
   3. Bidder has visited the site, become familiar with local conditions under which the Work is to be performed and has correlated the Bidder's personal observations with the requirements of proposed Contract Documents.
   4. Bid is based upon the materials, equipment and systems required by the Bidding Documents without exception.

1.14 BIDDING DOCUMENTS *

A. Bidders may obtain complete Bidding Documents as designated in Advertisement or Invitation to Bid.

B. Bidders shall use complete sets of Bidding Documents in preparing Bids; neither Owner nor Architect assumes responsibility for errors or misinterpretations resulting from use of incomplete sets of Bidding Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

BID DOCUMENT

REQUEST FOR INTERPRETATION

PROJECT: **ODPBC Courthouse Renovation Project**

PROJECT NO.: **241937**

FOR CONTRACTOR / SUBCONTRACTOR / VENDOR ROUTING:
Firm:

BD-RFI N0.: _____
Transmittal No.: _____
Date: _____

TO: **Attn.:** **John Rickert** Email to: John.Rickert@hdrinc.com
HDR Architecture, Inc.
8404 Indian Hills Drive; Omaha, NE 68114.

(Provide references and complete description of request with sketches or copy of document if necessary)
(Please type or print legibly)

SPEC. SECTION: _____ **DWG. NO.:** _____ **RM. NO.:** _____

REQUEST:

CM / CONTRACTOR / SUPPLIER: _____

ADDRESS: _____

PHONE NO.: _____ **FAX NO.:** _____

BY: _____ **DATE:** _____

REQUEST MUST BE RECEIVED AT LEAST 15 DAYS PRIOR TO BID OPENING!

If response is necessary, interpretations or supplemental instructions will be in the form of written addenda or clarification.

ARCHITECT'S ROUTING: **(for A/E use only)** A/E BD-RFI No.: _____

TO: DATE: _____

- ☐ Proj. Mgr. _____
- ☐ Coordinator _____
- ☐ Structural _____
- ☐ Mechanical _____
- ☐ Electrical _____
- ☐ Equip./Casework _____
- ☐ Civil / Landscape _____
- ☐ Interior Designer _____
- ☐ Specification Writer _____
- ☐ Project C.C.A. _____
- ☐ other _____

ACTION: ☐ Review & initiate addendum item if appropriate ☐ Review & provide input ☐ Info only
☐ Review & initiate change doc. if appropriate ☐ Other:

END OF FORM

SECTION 00 26 00
SUBSTITUTIONS PRIOR TO BIDDING

PART 1 - GENERAL

1.1 DEFINITION

A. Acceptable Manufacturers and Products: See Section 01 61 00.

B. Section includes administrative and procedural requirements for handling requests for substitutions made prior to bid.

C. Any product proposed by Contractor which does not meet requirements of Contract Documents, whether in product characteristics, performance, quality, manufacturer, or brand name is considered a substitution.

D. In case of non-availability of materials contact Architect for review and action.

E. For bidding purposes, base all bids on materials, equipment, and procedures specified, or approved by Addenda.

1.2 SUBSTITUTION PRIOR TO BIDDING REQUEST

A. Submit complete data substantiating compliance of proposed substitution with Contract Documents.

B. For products and systems:
   1. Product identification, including manufacturer's name.
   2. Manufacturer's literature marked to indicate specific model, type, size, and options to be considered:
      a. Product description.
      b. Performance and test data.
      c. Reference standards.
      d. Difference in power demand, air quantities, etc.
      e. Dimensional differences from specified unit.
   3. Samples:
      a. Architect reserves right to retain sample until physical units are installed on project for comparison purposes.
      b. Requester pay all costs of furnishing and return of samples.
      c. Architect is not responsible for loss of, or damage to samples.
   4. Name and address of at least five similar projects that proposed product has been in use on for at least four years, and name and phone number of owner's and architect's or engineer's representative, which Owner or Architect can contact to discuss product, installation, and field performance data.

C. For construction methods:
   1. Detailed description of proposed method.
   2. Illustrate with drawings.

D. Itemized comparison of proposed substitute to specified item; indicate variations.

E. Effect and changes required on other trades, subcontractors or contracts.

F. Data related to change in construction time.

G. Cost of proposed substitution in comparison with product, system or method specified.

H. Availability of maintenance and repair services, and sources of repair or replacement items.

I. Warranty comparison with specified product or system.

1.3 PRODUCT SELECTION - GENERAL

A. Certain types of products are described in Project Manual by means of trade names, catalog numbers or manufacturer's names, or both. This is not intended to exclude other products from consideration which may be capable of accomplishing purpose indicated.

B. Other types of products may be considered acceptable to Owner and Architect in place of those specified.

C. Listing of a manufacturer implies acceptance of them only as supplier of a product which complies with specified item.
   1. See Section 01 61 00 for definition of Base and Optional manufacturers.

D. No substitution permitted after execution of contract, unless allowed by Contract Documents.

E. Conditional bids and voluntary alternates will not be considered unless allowed by Instructions to Bidders.

1.4 SUBSTITUTION REQUESTS

A. Only written requests with complete data for evaluation will be considered.
   1. Request must be received at least 15 calendar days prior to bid date.
   2. Requests received late will not be considered.
   3. Submit evaluation data with attached form to Architect.

B. In making request for substitution, supplier and Contractor represent:
   1. Personal investigation of proposed product, system or method, has been conducted and determined it equal or superior in all respects to that specified, and will perform intended function.
   2. Product, system or method is in full compliance with applicable codes.
   3. Warranty for substitute item as for product, system or method specified meets or exceeds specified product.
   4. Finish products shall comply color wise and pattern wise with base specified items. Contractor will coordinate installation of accepted substitution into Work, to include building modifications if necessary, and be responsible for such modifications as may be required for Work to be complete and functional in all respects.
   5. Certified cost data is complete and includes all related costs, excluding Architect's review and redesign cost.
   6. Waives all claims for additional costs or time extensions related to substitution which subsequently become apparent or are caused by substitution.
   7. Pay additional costs to other trades, subcontractors or contracts caused by substitution.
   8. Pay all Architect's review and redesign cost, special inspections, and other costs incurred by substitutions or revisions made necessary by acts or omissions of Contractor, due to product submittal or product not being ordered in a timely manor, due to ease of construction progress or Work, or which are in interest of or are for convenience of supplier, subcontractor or Contractor.
   9. Acknowledge acceptance of these provisions.

C. Supplier to sign substitution request in space provided on form acknowledging acceptance of terms.

D. Contractor sign request in space provided on form acknowledging it's acceptance of terms.

1.5 APPROVAL OF SUBSTITUTION REQUEST

A. No verbal or written approvals other than by Addenda will be valid.
   1. Addendum listing approved substitutions will be published prior to Bid date.

1.6 REJECTION OF SUBSTITUTION REQUESTS

A. Substitutions may not be considered if:
   1. Submitted after stipulated date or time period.
   2. Not submitted in accord with this Section.
   3. Acceptance will require substantial revision of Contract Documents, building or system.
   4. Substitution request does not indicate specific item for which request is submitted.
   5. Substitution Request form is not properly executed and signed.
   6. Substitution request for manufacturer acceptance only.
   7. Insufficient information submitted.
   8. Substitution color or pattern wise does not comply with base specified item.
   9. Substitution does not appear to comply with requirements of specifications for base item.

END OF SECTION

SUBSTITUTION REQUEST

PROJECT:

PROJECT NUMBER:
TO: Office of Architect:
HDR Architecture, Inc.
8550 W Bryn Mawr Avenue, Suite 900
Chicago, IL 60631-3223
Attention:_____

SPECIFIED PRODUCT:
Substitution request for: _____
Specification Section number: _____
Article(s)/paragraph(s): _____

REASON FOR SUBSTITUTION REQUEST:

- ☐ Fails to comply with building code requirements
- ☐ Unavailable to meet Project schedule
- ☐ No qualified installer for specified item
- ☐ Supplier refuses to warrant item or installation
- ☐ Supplier, Subcontractor or Contractor convenience
- ☐ Other:
- ☐ Not available
- ☐ Reduce Project construction time
- ☐ Project cost savings
- ☐ Unsuitable for application
- ☐ Constructability issue

Explanation in Detail: ☐ See attached: _____

SUPPORTING DATA:
Attach product description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation of the proposed substitution in accord with requirements of Section 00 26 00.

Sample is included: Yes ☐ No ☐
Sample will be sent if requested: Yes ☐ No ☐
Maintenance Service Available: Yes ☐ No ☐
If yes, location: _____
Spare Parts Source: _____

PRODUCT/SYSTEM COMPARISON:

Provide a one-to-one comparison of proposed substitution with ALL specified attributes and qualities of specified item(s)

	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION
Manufacturer:		
Name, brand:		
Catalog No.:		
Unit Cost:		
Attributes /		
Qualities /		
Variations /		
Warrantee /		
etc:		

REFERENCES:

LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: ______________________________
Address: ______________________________
Architect (name a phone): ______________________________
Owner (name & phone): ______________________________
Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name & phone): ______________________________
Owner (name & phone): ______________________________
Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name & phone): ______________________________
Owner (name & phone): ______________________________
Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name & phone): ______________________________
Owner (name & phone): ______________________________
Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name & phone): ______________________________
Owner (name & phone): ______________________________
Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name & phone): ______________________________
Owner (name & phone): ______________________________
Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

EFFECT OF SUBSTITUTION:

Substitution affects other parts of Work:	No ☐	Yes ☐	(If yes, explain below)
Substitution requires dimensional revision or redesign of structure or mechanical and electrical Work:	No ☐	Yes ☐	(If yes, explain below)
Same warranty provided as specified base product:	No ☐	Yes ☐	(If no, explain below)

Explanation: _____

_____

Cost difference:	$ _____	(add / deduct).
Total cost implications of substitution on Project:	$ _____	(add / deduct).
Total time implications:	$ _____	(add / deduct) calendar days.

STATEMENT OF CONFORMANCE OF REQUEST TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor and Contractor in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposed substitution and determined it is equal or superior in all respects to specified product or system and will perform intended function, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of accepted substitution into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to substitution that subsequently become apparent or are caused by substitution.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect's review and redesign cost.
- ☐ Will pay Architect's review and redesign cost, special inspections, and other costs caused by substitution.
- ☐ Will pay additional costs to other contractors caused by substitution.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments: _____

_____

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF FOLLOWING PRODUCT OR SYSTEMS AS A SUBSTITUTION IN ACCORD WITH PROVISIONS OF CONTRACT DOCUMENTS:

Supplier/Vender: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

Subcontractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

Contractor: _____

Acknowledged by (print & sign): _____ Date: _____

Position: _____ Phone _____

END OF SUBSTITUTION REQUEST

DIVISION 01

GENERAL REQUIREMENTS

SECTION 01 14 16
COORDINATION WITH OCCUPANTS AND WORK RESTRICTIONS

PART 1 - GENERAL

1.1 SECTION INCLUDES

A. Contractor use of site and premises.

B. Working days and hours

C. Directed premium time

D. Future work.

E. Work sequence.

F. Owner occupancy.

G. Disruption of existing services.

1.2 CONTRACTOR USE OF SITE AND PREMISES

A. Use of site: Limit use and operation at site to “Limits of Construction,” indicated and required to perform Work.

B. Portions of site beyond area of required Work shall not be disturbed without written approval of Owner.
   1. Portions of site beyond area of required Work shall not be disturbed without written approval of Owner.
   2. Obtain written approval from Owner at least seven (7) calendar days in advance when scheduling Work outside limits of construction. Provide Owner an estimate of time needed to perform Work outside limits of construction.
   3. Cutting, capping, and reconnecting utility systems outside limits of construction shall be performed by Contractor, unless otherwise noted.
   4. Conform to all laws, ordinances, permits and regulations affecting Work on site.
   5. Existing roads, streets, drives, parking lots, entrances and required fire exit ways shall be kept clear and available at all times for their intended use.
      a. Do not use these areas for parking, staging or storage without Owner’s written approval.
      b. Coordinate with Owner, and provide alternate routes for public and Owner access if normal routes are affected.
   6. Do not unreasonably encumber site with equipment, materials or vehicles.
   7. Return all improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed; to conditions which existed previous to starting performance under Contract.

C. Use of facilities:
   1. Limit use and operation within existing facilities to areas indicated for construction Work and as required to perform Work. Other areas within facility shall not be disturbed or disrupted.
   2. Perform Work so as not to interfere or inconvenience public, staff and Owner’s operation.
   3. Maintain and keep clear all required fire exit ways throughout facility within and in vicinity of construction areas. Coordinate alternate temporary egress routes with Owner and local fire authority.
   4. Do not load structure with weights that will endanger structure.
   5. Smoking is prohibited within facilities or on Owner’s property.

6. Audio devices and radios are prohibited, except two-way radios needed for Contractor's operations. Use of two-way radios within occupied facilities shall be limited, so not to disrupt occupants.
7. Use of toilet facilities, washrooms, and telephones within existing facility or occupied areas is not allowed without Owner's consent.
8. Elevators in existing facility or within occupied areas of addition may not be used by construction personnel without Owner's consent and such use shall meet following conditions:
   a. Protect and maintain entire system and finishes during use.
   b. Repair or replace any damaged components of system and finishes.
   c. Clean all finishes.
9. Cafeteria and dining areas may not be used by construction personnel without Owner's consent.
10. Clothing with derogatory depictions, language, and/or slogans regarding alcohol, drugs, race or sexual in nature, shall not be worn on premises.
11. Coordinate construction operations to assure that operations are carried out with consideration given to conservation of energy, water, and materials.
12. Maintain existing building in a weather tight condition throughout construction period.
13. Repair damage and leaks caused by construction operations.
14. Take all precautions necessary to protect building and its occupants during construction period.
15. Make every effort to keep noise to a minimum in construction operation.
16. Jack hammer will not be permitted to use within the existing building without Owner's consent.
17. Derogatory language regarding race, sexual or religious in nature, shall not be used on premises.

A. Limit Use of Site and Premises to Allow:
   1. Owner occupancy.
   2. Work by Others.
   3. Work by Owner.
   4. Use of site and premises by public.

1.3 WORKING DAYS AND HOURS

A. Days: Sunday - Saturday.

B. Hours: 6 PM to5 AM Monday – Friday; anytime Saturday and Sunday.

C. Work performed during Holidays or other than normal working days or hours shall be scheduled in advance with, and approved by Owner.

1.4 DIRECTED PREMIUM TIME

A. Actual premium wages paid for original contract Work directed by Owner to be performed other than normal working hours, including; social security taxes, unemployment insurance, and union fringe benefits if required by union agreements; to be without overhead and profit mark-ups.
   1. Any Owner approved scheduled utility line tie-in or shutdown that affect building operation that is not allowed to be competed during normal working hours shall be completed on premium time basis.

1.5 WORK SEQUENCE

A. Coordinate operations and construct Work in phases to accommodate Owner's occupancy requirements during construction period:
   1. See phasing plans
   2. Bid Contract: June - July 2015
   3. Award Contract: August 14, 2015
   4. Contractor Prep: August 15 thru October 1, 2015

5. -Phase 1a and 1b: 6th Floor (9 months, Oct. 2015-June 2016)
   a. Impact
      1) Lose Holding Cells (except 2 Juvenile individual cells and Data Room).
      2) Lose Sheriff Office, Locker Rooms and Breakroom.
      3) Lose HVAC for Douglas County Attorneys Juvenile Div. – temporary air will need to be provided.
      4) Resolution
      5) Move Sheriff temporarily to 2nd Floor SW area.
   b. Remarks
      1) No Courtroom loss during this phase.
      2) When Phase 1 is completed we will have new Courtroom #625.

6. -Phase 1a: 3rd Floor North (4 ½ months, Oct. 2015-Feb. 15, 2016)
   a. Impact
      1) Probate Administrative staff area will need to be temporarily reduced in size and may need to relocate some staff.
      2) Will need to provide a temporary Customer Service counter.
      3) Will need storage space for their files.
   b. Remarks
      1) Gain full size Courtroom #332 to replace Hearing Room #332, providing 1 additional Courtroom.
      2) Gain Jury Deliberation Room.

7. -Phase 1b: 3rd Floor South (4 ½ months, Feb. 16, 2016-June 2016)
   a. Impact
      1) Lose two (2) Judges Chambers and their staff area.
      2) Lose one (1) Courtroom #331 and Hearing Room #332.
   b. Resolution
      1) Move Chambers and Hearing Room #332 temporarily to existing 1st Floor District Court Conference Rooms.
      2) Move Judges Staff temporarily to 1st Floor Conciliation Conference Room or Jury Assembly.
   c. Remarks
      1) We lose Courtroom #331 however gain #625.

8. -Phase 2: 2nd Floor West (18 months, July 2016-Jan. 2018)
   a. Impact
      1) Totally vacate and demo entire West side to include all HVAC (AHU-20).
      2) Lose two (2) Courtrooms (#225 & #226) however no Courtroom capacity impact due to Hearing Room #332 replaced with full size Courtroom #332. In addition new Courtroom #625 was created in Phase 1.
      3) Lose three (3) Judges Chambers and staff area.
      4) Lose Holding Cells and Sheriff's area.
      5) Must relocate City Prosecutor's office.
      6) Lose HVAC for parts of 1st, 2nd, 3rd and 4th Floor (still have perimeter heat).
      7) Temporary cooling will need to be provided depending on season.
   b. Resolution
      1) Move City Prosecutor temporarily to vacated Civic Center Douglas County Treasurer area.
      2) Provide a temporary Kiosk location for a Prosecutor Customer Service Clerk.
      3) Move three (3) Judges Chambers temporarily to 1st Floor HOJ District Court Conference Room.
      4) Move Judges staff temporarily to 1st Floor Conciliation Conference Room or Jury Assembly Area.
      5) Temporarily move Sheriff and Holding Cells to 6th Floor.
   c. Remarks

1) 6th Floor Holding Cells now fully functional.
2) Create four (4) new Courtrooms, #226, #227, #228 and #229.
3) Create six (6) new Judges Chambers and their staff areas.

9. -Phase 3: 2nd Floor East (18 months, Feb 2018- Aug.2019)
   a. Impact
      1) Lose three (3) Courtrooms however new ones have already been built in 2 West.
      2) Criminal Traffic must relocate.
      3) Temporarily lose three (3) Judges Chambers however new ones have already been built in 2 West.
   b. Resolution
      1) Relocate Criminal Traffic to either 1st Floor Jury Assembly or Farnam Lunchroom South side
      2) Build temporary Kiosk in Rotunda for Criminal Traffic Payment windows
   c. Remarks
      1) New area created for City Prosecutor
      2) Criminal Traffic increases in size and provides for twelve (12) new Customer Service windows.

1.6 OWNER OCCUPANCY

A. Owner will occupy portions of the premises during entire period of construction coordinate all construction and phasing with owner.

B. Work is required to be performed within existing building. Each Contractor will have access to areas in which this work occurs, subject to rights of Owner.

C. Owner will occupy existing building during life of this contract.

D. Schedule all work at such time and in such a manner to minimize interference and inconvenience to public, staff and Owner’s operations.

E. Contractor must obtain approval of Owner before starting any work within any existing area of building.

F. Area immediately surrounding all areas of Work shall be protected from danger of materials being dropped or dislodged.

G. Work shall be carried out in a manner that will not impose avoidable hardship, danger, or inconvenience to public or staff.

H. Prior to commencement of Work, Contractor and Owner shall jointly survey construction site and surrounding areas, making permanent record of such existing damage as cracks, malfunctioning utility equipment and fixtures, or other similar damage.
   1. This record shall serve as a basis for determination of subsequent damage to these structures and adjacent areas due to Contractor’s operations.

I. Any damage of any nature to these structures and adjacent areas not noted in original survey but subsequently noted, shall be reported immediately to Owner.

J. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.

K. Schedule work to accommodate this requirement.

1.7 DISRUPTION OF EXISTING SERVICES

A. Work shall be planned so as to minimize shutdown time of any service.
   1. Request approval of a utility or equipment shutdown in writing to Owner not less than seven (7) working days before time shutdown is desired.
   2. Provide Owner an estimate of duration of shutdown and how facility is going to be affected.
   3. Coordinate with Owner’s building engineering staff in advance of any shut down.

4. Begin work only after engineering staff is fully informed and has agreed to schedule of shut offs.
5. Do not cut into existing services without first verifying with Owner that service has been correctly identified and shut off.
6. Operation of existing valves, switches, etc., to affect service shutdown will be completed by Owner, unless arranged otherwise.

B. Limit duration of each such disruption of service to maximum of 4 hours or as approved by Owner.

C. Fabricate and install interconnecting portions of these systems prior to shut down for final connections.

D. Maintain utilities or other service, indicated to be abandoned, in service or provide alternate means of service until new facilities are provided, tested, and put in operation.

E. Maintain fire protection and fire alarm systems at all times within existing facilities.

F. Review all existing conditions, drawings and other documents for proper coordination between new and existing construction.

G. Active utilities whose locations are unknown to Owner are suspected to exist. Contractor shall be cautious of their existence. If they are encountered, immediately report to Owner for direction.

H. Damages to existing structures, utilities and other items which are caused by Contractor's operations shall be repaired or replaced to their original conditions by Contractor at Contractor's expense.

END OF SECTION

SECTION 01 21 16
CONTINGENCY ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

A. Contingency Allowance is established to account for portions of Work that were not fully coordinated, incorporated, or documented in Contract Documents prior to award of contract. In some cases, items may have been deferred to a later date when additional information is available.

B. Contingency Allowance is for exclusive use of Owner and Architect for changes as a result of design refinements, clarifications, inconsistencies, errors, omissions, and unanticipated design issues.
   1. Not for Contractor's unknown or unanticipated conditions or Owner's scope changes.
   2. Not for use by Contractor as Contractor's construction contingency.
   3. Not for Owner scope changes.
   4. Owner and Architect approval of contingency adjustment required prior to adjusting Contingency Allowance for approved changes.
   5. Contingency Allowance adjustments will include Contractor's related costs, and reasonable overhead and profit as stipulated in Contract Documents.

1.2 ALLOWANCE

A. Contractor include in Base Bid Lump Sum and Contract Sum, Contingency Allowance equal to four (4%) of the proposed bid amount.
   1. Include Contingency Allowance sum on Bid Form as separate line item.
   2. Base Bid Lump Sum and Contract Sum shall not include Contractor's overhead and profit on Contingency Allowance.
   3. At Project closeout and prior to Final Payment the final Contract Sum shall be adjusted accordingly by Change Order.
      a. Amount of the Change Order shall reflect difference between actual costs of all approved contingency adjustments and the Contingency Allowance.

END OF SECTION

SECTION 01 23 04
CHANGES IN WORK

PART 1 - GENERAL

1.1 SUMMARY

A. This Section defines administrative and procedural requirements for handling and processing Changes in Work.

B. Provisions within this section take precedence over provisions in General Conditions governing Changes in Work.

C. Provisions followed by an asterisk (*) include some or all provision as obtained from AIA Document A201- General Conditions of the Contract for Construction.

1.2 DESCRIPTION

A. Changes in Work may be accomplished after execution of Contract, and without invalidating Contract, by Change Order (CO), Change Proposal Request (CPR), Construction Change Directive (CCD) or order for a minor change in Work, subject to the limitations stated in this Section and elsewhere in Contract Documents. *
   1. A Change Order or Change Proposal Request shall be based upon agreement among Owner, Contractor and Architect.*
   2. A Construction Change Directive requires agreement by Owner and Architect and may or may not be agreed to by Contractor.*
   3. An order for a minor change in Work may be issued by Architect alone. *

B. Changes in Work shall be performed under this Section and other applicable provisions of Contract Documents, and Contractor shall proceed promptly, unless otherwise provided in a Change Order, Change Proposal Request, Construction Change Directive or order for a minor change in Work. *

C. Contractor may anticipate a minimum of 120 change documents being issued during Project duration: however such quantities shall not guarantee nor limit total quantity of changes.

D. Manage changes issued so as not to adversely affect Project Schedule.

E. Neither Owner nor Architect recognize “reservation of rights” or similar language from Contractor that would state or purport to preserve ability to make additional claims or demands related to a change, not in conformance with terms and provisions provided by Contract Documents.
   1. All Claims or other demands for changes, compensation or an extension of time must be made in strict conformance with the provisions of Contract Documents.
   2. Agreement on any Change Order, Construction Change Directive or Change Proposal Request shall constitute a final settlement of the event and all matters related thereto.
   3. Contractor waives and releases Owner and Architect of all direct material costs, labor costs, equipment costs, overhead and profit, costs or losses due to productivity loss, morale, attitude, staffing changes, supervision, acceleration, delay, interference, logistics, fatigue, ripple effect, overtime, time extensions related to costs, and other costs related to any change that are not expressly included in an agreement on any Change Order, Change Proposal Request or Construction Change Directive.

F. Any verbal or other informal orders provided by Owner or Architect should only be considered as temporary or emergency instructions.
   1. All verbal or other informal orders shall be formally documented, using one of procedures indicated in this Section.

2. Should Contractor choose to proceed with any verbal or informal instructions, Contractor does so at their own risk.
3. Should Contractor not receive written verification of verbal or informal instructions in a timely manner, Contractor should request verification using Request for Information (RFI) process.
4. Under no circumstances should Contractor proceed with any verbal or informal instructions which might result in a change to Contract Sum or Contract Time until an approved Change Order or Change Proposal Request is received.

G. Incorporate approved changes in Project Record Documents and in Construction Schedules for Project.
   1. Submit revised schedules for Project to Owner and Architect.

PART 2 - PRODUCTION - NOT USED

PART 3 - EXECUTION

3.1 CHANGE ORDERS*

A. A Change Order (CO) is a written instrument prepared by Architect and signed by Owner, Contractor and Architect, stating their agreement upon following:
   1. Change in Work,
   2. amount of adjustment, if any, in Contract Sum, and
   3. extent of adjustment, if any, in Contract Time.

3.2 CHANGE PROPOSAL REQUEST

A. Change Proposal Request (CPR) is prepared and initiated by Architect at Owner's request or may be issued in response to an Request for Information which has a cost or time impact, or some other required or desired change in the Work that may require an adjustment to Contract Sum or Contract Time.
   1. Change Proposal Requests will include a description of proposed change and may include supplemental or revised Drawings and Specifications, or written instruments prepared by Architect.
   2. Initiation and issuance of a Change Proposal Request is not direction to either stop Work in progress or to proceed with change.
   3. Architect will notify Contractor by email when document has been issued and posted to HDR's web-based Project Tracker Collaboration System (PTCS).
   4. Contractor will access Project Tracker Collaboration System to download electronic documents for further processing.
   5. Upon receipt, Contractor and Subcontractors shall review and evaluate scope of change, and potential impact on Project.
      a. If potential impact to schedule, Contractor shall immediately initiate and forward Change Proposal Impact Evaluation to Owner for processing.
      b. If potential impact, Owner may direct Contractor to stop Work in area affected by change to minimize cost impact, or may issue a Construction Change Directive directing Contractor to proceed with change.
   6. Evaluate Subcontractor's cost proposals, make recommendations and submit proposal to Architect on CPR form issued by Architect within twenty-one (21) days of receipt so not to delay progress of Project.
      a. Proposals shall include Contractor's Cost Summary form from Contractor and each Subcontractor with complete itemized accounting, together with appropriate supporting data to substantiate adjustments in Contract Sum and Contract Time, including labor, materials and equipment.

B. Method used to determine an adjustment in Contract Sum shall be limited to following:
   1. Labor Wages: Itemized by each craft involved, indicating hourly rate for each and hours required, excluding premium pay, paid to employees directly engaged in Work.
      a. Rates shall be the actual rate paid the workman in accordance with established management labor agreements.
      b. Labor rates indicated in Contractor Agreement or Subcontractor Agreements are not applicable if they cannot be substantiated in writing as direct labor burden when requested by Owner or Architect.
   2. Labor Burden: Percent of actual wages for each craft including:
      a. Mandatory fringe benefits required by established agreements.
      b. Health and Welfare.
      c. Pension.
      d. Apprenticeship and other required programs.
      e. Social Security.
      f. Unemployment Insurance.
   3. Subsistence, Mileage, or both: If in union agreements.
   4. Materials and Equipment: Materials incorporated in Work at Contractor's actual invoice cost, including freight and applicable sales tax, and any volume or other discounts.
      a. Indicate rates and units required.
   5. The amount of credit to be allowed for a deletion or change which results in a net decrease in Contract Sum shall be net cost.
      a. When both additions and credits covering related Work or substitutions are involved in a change, allowance for overhead and profit shall be figured on the basis of net increase, if any, with respect to that change.
   6. Overhead and Profit: Fifteen percent (15 percent) of net increase of labor and material for work performed by own forces including, but not limited to:
      a. Project Manager.
      b. Estimating.
      c. Field supervision above foremen level superintendents.
      d. Assistant superintendents.
      e. General foremen.
      f. Engineers.
      g. Accountants.
      h. Timekeepers.
      i. Office managers and others on staff.
      j. Office supplies.
      k. Computers and software.
      l. Drinking water.
      m. Temporary heat.
      n. Temporary cooling.
      o. Light and power.
      p. Sanitation facilities.
      q. Small tools valued at $500 or less.
      r. Record documents; and other
      s. All cost of materials, equipment or both not incorporated in Work or directly associated with Work, including home office and on site office costs.
   7. Directed Premium Time on Contract Work: Actual premium portion of wages for original contract Work which was directed by Owner to be performed other than normal working hours, including:
      a. Social Security Taxes.
      b. Unemployment Insurance.
      c. Union Fringe Benefits if required by Union Agreements.
   8. Major Construction Equipment:
      a. Owned: Cost not to exceed eighty-five percent (85 percent) of current prevailing rates or blue book rates for rental of appropriate equipment for job and time period of use.

b. Leased: Contractor's reasonable invoiced cost, except lease-purchase equipment which is considered "Contractor owned".

9. Contractor's overhead and profit on Subcontractor's Work: Contractor's overhead and profit on Subcontractor's Work shall not exceed five percent (5%) on net increase of Work performed by Subcontractor.
10. Subcontractor overhead and profit markup is not allowed on their Sub-subcontractor's Work.
11. Subcontractor Cost: Quote in same manner as prescribed herein for "Contractor".
12. Bond and Insurance: Actual amount based on net increase or deduct to be paid to surety and insurance carrier.

C. Only delay impacting critical path of Work shall be considered when determining if Contractor is entitled to additional time.
   1. If proposals include a change in time, Contractor shall substantiate number of days proposed.
      a. An estimate of cost and of probable effect of delay of the Work progress and Project schedule shall be included to substantiate potential delay, including a comparison of Project Construction Schedule and schedules prepared to substantiate a change in time.
      b. Indicate in CPM format both critical and non-critical path activities affected, and show Project Construction Schedule and change sequences, durations and float.

D. Owner shall have right within its sole discretion to require Contractor to commence performance of changes to Work prior to submission by Contractor of proposal, or Owner's approval of proposal.
   1. Proceed with Work upon receipt of a Construction Change Directive from Owner, and thereafter submit to Owner and Architect as soon as possible any cost proposal required for approval.

E. Change Proposal Request signed by Contractor and Owner indicates agreement therewith, and shall be considered a Change Order.
   1. Contractor is authorized to proceed with the change after Owner approval thereof.

F. Construction Change Directive may be prepared if Contractor's proposal is not acceptable or change need be expedited to reduce or eliminate impact on project.

3.3 CONSTRUCTION CHANGE DIRECTIVES

A. A Construction Change Directive (CCD): Written order prepared by Architect or Owner and signed by Owner, directing a change in Work prior to agreement on adjustment, if any, in Contract Sum, Contract Time, or both.
   1. Owner may by Construction Change Directive, without invalidating Contract, order changes in Work within general scope of Contract consisting of additions, deletions or other revisions, Contract Sum and Contract Time being adjusted accordingly.*

B. Construction Change Directive may be used in absence of total agreement on terms of a Change Order or Change Proposal Request.*

C. If Construction Change Directive provides for an adjustment to Contract Sum, the adjustment shall be based on one of following methods: *
   1. Mutual acceptance of a lump sum properly itemized and supported by sufficient substantiating data to permit evaluation, *
   2. Unit prices stated in Contract Documents or subsequently agreed upon, *
   3. cost to be determined in a manner agreed upon by the parties and a mutually acceptable fixed or percentage fee,
   4. or as provided in Paragraph 3.2 B and C.

D. Upon receipt of a Construction Change Directive, proceed with change in Work involved and advise Owner and Architect of Contractor's agreement or disagreement with method, if any, provided in Construction Change Directive for determining proposed adjustment in Contract Sum or Contract Time.*

E. Failure of Contractor and Owner to agree on an adjustment of Contract Sum or Contract Time shall not excuse Contractor from proceeding with prosecution and performance of Work. Contractor and Subcontractors, Sub-subcontractors and Suppliers shall administer all disputes in a manner that will permit Work to proceed on schedule while matter in dispute is being resolved.

F. Construction Change Directive signed by Contractor indicates agreement of Contractor therewith, including adjustment in Contract Sum and Contract Time or method for determining them.
   1. Such agreement shall be effective immediately and shall be recorded as a Change Order.*

G. The amount of credit allowed by Contractor to Owner for a deletion or change which results in a net decrease in Contract Sum shall be actual net cost.*
   1. When both additions and credits covering related Work or substitutions are involved in a change, the allowance for overhead and profit shall be figured on basis of net increase, if any, with respect to that change.*

H. Present an itemized accounting together with appropriate supporting data in accordance with Paragraph 3.2 B and C.

I. When Owner and Contractor reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.*

J. For any portion of such cost that remains in dispute, Owner shall hire independent professional estimator to make determination. Resulting determination of cost shall adjust Contract Sum, subject to right of either party to disagree and assert a claim.*

K. When Owner and Contractor agree with determination made by independent professional estimator concerning the adjustments in Contract Sum and Contract Time, or otherwise reach agreement upon the adjustments, such agreement shall be effective immediately and shall be recorded by preparation and execution of an appropriate Change Order.*

3.4 MINOR CHANGES IN WORK

A. Architect has authority to order minor changes in Work not involving adjustment in Contract Sum or extension of Contract Time and not inconsistent with the intent of Contract Documents.*

B. Such changes shall be effected by written order and shall be binding on Owner and Contractor.*

C. Following may be used as a written order to order minor change in the Work:
   1. Clarification-Interpretation (C-I) or Architect's Supplemental Instruction (ASI) issued by Architect.
   2. Response to a Request for Information by Architect.
   3. Architect's comments or direction on a Contractor's Submittal.
   4. Minor changes indicated in Architect's project visit report.

D. Contractor shall carry out such written orders promptly. *

E. If Contractor perceives direction in a written order requires adjustment to Contract Time or Contract Sum, Contractor shall not execute such direction, and shall submit a claim to Architect along with substantiation within twenty-one (21) working days of receipt of such written order.

3.5 CONTRACTOR'S PROPOSED CHANGES TO WORK

A. Architect and Owner may consider properly prepared, timely Contractor Proposed Changes (CPC) to Work, if requested by Owner or Architect, or at any time Contractor believes unforeseen conditions may require modifications to the Contract Sum or Contract time.
   1. A Contractor Proposed Change shall be properly prepared, accompanied by proposed cost, sufficient supporting data and information to permit Architect to make a reasonable determination without extensive investigation to determine if change may be considered warranted.
      a. Include a statement outlining reasons for change and effect of change on Work.

b. Provide a complete description of proposed change.
c. Indicate effect of proposed change on Contract Sum and the Contract Time.
d. Include a list of quantities of products required or eliminated and unit costs, with total amount of purchases and credits to be made.
    1) Indicate separately any credit due Owner for products eliminated.
    2) If requested, furnish survey data to substantiate quantities.
e. Indicate applicable taxes, delivery charges, equipment rental, and amounts of trade discounts.
f. Include costs of labor and supervision directly attributable to change and identify separately any credit for work previously bid but would be eliminated.
g. In event proposed change effects construction schedule, include an updated Contractor's Construction Schedule indicating effect of change, including, but not limited to:
    1) Changes in activity duration.
    2) Start and finish times.
    3) Activity relationship.
    4) Use available total float before requesting an extension of Contract Time.
    5) Document use of float or proposed alternate methods to maintain original schedule or both.

2. Contractor Proposed Change shall be submitted to Architect in such format and on such form included herein or as Architect may require.

B. Architect will take appropriate action on Contractor Proposed Changes.
1. Architect may issue an order for a minor change in Work if it is determined that proposed change is not materially different from requirements of Contract Documents.
2. Architect may incorporate proposed change into a change document and issue for Owner's consideration.
3. If Architect determines that implementation of proposed change would result in a material change to Contract that may cause an adjustment in Contract Time or Contract Sum, Architect may make a recommendation to Owner who may authorize further evaluation of proposed change or may authorize issuance of such change.
4. Architect may reject such proposed change if it will require substantial revisions to Contract Documents, building or systems or if Architect determines they are not appropriate or substantiated.

END OF SECTION

CHANGE PROPOSAL IMPACT EVALUATION

PROJECT: **CPR NO.:**

HDR PROJECT NO.:

TO OWNER:

We have reviewed and evaluated the scope of above referenced change and potential impact on Project. If the change is required or desired we recommend following in order to expedite Work and avoid or minimize delays in the Work which may affect cost of the change or impact to the schedule:

- ☐ Recommend Work stop in area affected by this change for _____ calendar days so change can be priced and processed. Contract Sum or Contract Time due to stopping Work will not increase.
- ☐ Recommend proceeding with change immediately:
  1. Proposed basis of adjustment to Contract Sum or Guaranteed Maximum Price is:
     - ☐ No additional cost.
     - ☐ GMP amount will not change. Cost indicated will be taken from GMP Contingency.
     - ☐ Lump Sum (increase) (decrease) of $ _____
     - ☐ Unit Price of $ _____ per _____
     - ☐ Time & Materials, not to exceed $ _____
       (Daily time, material, and equipment documentation required for above)
     - ☐ As follows: _____
       (Method used in determining above adjustments shall be as defined in Contract Documents)
  2. Contract Time is proposed to (be adjusted) (remain unchanged), by an (increase) (decrease) of _____ calendar days.

FROM: CM or CONTRACTOR: _____

BY: _____ DATE: _____

DISTRIBUTION: ☐ OWNER ☐ ARCHITECT ☐ _____

CONSTRUCTION CHANGE DIRECTIVE

TO CM / CONTRACTOR: _____

You are hereby directed to:

- ☐ Stop work in area affected by above referenced change until it has been processed and appropriate action taken.
- ☐ Proceed with above referenced change immediately.

When signed by Owner and received by CM/Contractor, this document becomes effective IMMEDIATELY as a Construction Change Directive (CCD), and CM/Contractor shall proceed based per above.

FROM OWNER: _____

BY: _____ DATE: _____

DISTRIBUTION: ☐ CONTRACTOR ☐ ARCHITECT ☐ _____

CONTRACTOR'S COST SUMMARY

PROJECT: **CHANGE DOCUMENT:**

PROJECT NO.:
CONTRACTOR: **DATE:**
SUBCONTRACTOR: **DATE:**

This form, itemized accountings and appropriate supporting data must be attached to any change documents or claim.

(Only fill in applicable line items)

1. Labor * (including benefits) $ _____ (Attach Cost Summaries and breakdowns)
2. Materials and Products * $ _____ (Attach Cost Summaries and breakdowns)
3. (Subtotal of lines 1 and 2) $ _____
4. Overhead and Profit (15% of line 3) $ _____
5. Premium Time on Contract Work $ _____
6. Major Construction Equipment Rental * $ _____ (Shall not exceed A.E.D. Schedules)
7. Subcontractor's name and cost:
   (Attach Cost Summaries and breakdowns) Work Category:

a		$	
b		$	
c		$	
d		$	
e		$	
f		$	
g		$	
h		$	
i		$	
j		$	
k		$	
l		$	
m		$	
n		$	
o		$	
p		$	
q		$	

8. Total Subcontractor cost (total of lines 7a through 7q) $ _____
9. Contractor's O & P on Sub's. Work (5% of line 8) $ _____
10. (Subtotal of lines 3, 4, 5, 6, 8 and 9) $ _____
11. Bond ____% and Insurance ____% (if required) = ____% of line 10 $ _____

12. TOTAL PROPOSED COST ADJUSTMENT (total of lines 10 and 11): $

13 PROPOSED CONTRACT TIME ADJUSTMENT : _____ ☐ADD ☐DEDUCT (calendar days)
(Provide supportive data substantiating claim for additional days in accordance with Contract Documents)

* Attach complete breakdown of itemized accounting and supporting data, sufficient to permit evaluation.

CONTRACTOR PROPOSED CHANGE

PROJECT: _____

HDR PROJECT NUMBER: _____

TO: HDR Architecture, Inc.

REASON FOR PROPOSAL:

- ☐ Design to comply with building code requirements
- ☐ Product / material unavailable to meet Project schedule
- ☐ No qualified installer for specified item
- ☐ Supplier refuses to warrant product or installation
- ☐ Project cost cutting / cost reduction
- ☐ Supplier, Subcontractor or Contractor convenience
- ☐ Product not available
- ☐ Reduce Project construction time
- ☐ Unanticipated / existing condition
- ☐ Specified product / system unsuitable for application
- ☐ Owner suggested or requested
- ☐ Constructability issue
- ☐ Value Engineering (may be used for "Value Engineering Change Proposal" govern by Federal Acquisition Regulations)
- ☐ Other:

Explanation in Detail: ☐ See attached: _____

REASON FOR NOT GIVING PRIORITY TO SPECIFIED METHOD, ITEMS OR SYSTEM: ☐ See attached:

REFERENCES:

Specification Section number: _____ Article(s)/paragraph(s): _____

Drawings / Sections / Details: _____

DESCRIPTION OF PROPOSAL:

SUPPORTING DATA:

Attach description, specifications, drawings, photographs, performance data, test data, environmental criteria, and any additional data or information for evaluation.

Sample is attached: Yes ☐ No ☐

Sample will be sent if requested: Yes ☐ No ☐

Maintenance Service Available: Yes ☐ No ☐

If yes, location:

Spare Parts Source:

PRODUCT / SYSTEM COMPARISON:

Provide a one-to-one comparison of proposed item with ALL specified attributes and qualities of specified item(s)

	SPECIFIED PRODUCT	PROPOSED SUBSTITUTION
Manufacturer:		
Name, brand:		
Catalog No.:		
Unit Cost:		
Attributes /		
Qualities /		
Variations /		
Warranty /		
etc:		

REFERENCES:
LIST MINIMUM OF FIVE PREVIOUS INSTALLATIONS, WHICH PROPOSED METHOD / SYSTEM / PRODUCT HAS BEEN INSTALLED FOR AT LEAST FOUR YEARS:

Project: ______________________________
Address: ______________________________
Architect (name and phone): ______________________________
Owner (name and phone): ______________________________
General Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name and phone): ______________________________
Owner (name and phone): ______________________________
General Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name and phone): ______________________________
Owner (name and phone): ______________________________
General Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name and phone): ______________________________
Owner (name and phone): ______________________________
General Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name and phone): ______________________________
Owner (name and phone): ______________________________
General Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

Project: ______________________________
Address: ______________________________
Architect (name and phone): ______________________________
Owner (name and phone): ______________________________
General Contractor: ______________________________
Date Installed: ______________________________
Dollar Value this Work: $ ______________________________

EFFECT OF PROPOSAL:

Affects on other parts of Work:	No ☐	Yes ☐	(If yes, explain below)
Proposal requires dimensional revision or redesign of structure or mechanical and electrical Work:	No ☐	Yes ☐	(If yes, explain below)
Same warranty provided as specified item:	No ☐	Yes ☐	(If yes, explain below)

Explanation: _____

Cost difference:	$ _____	(increase / decrease)
Total Contract Sum implications of proposal on Project:	$ _____	(increase / decrease)
Total Contract Time implications:	_____	(increase / decrease) calendar days.

STATEMENT OF CONFORMANCE OF PROPOSAL TO CONTRACT REQUIREMENTS:

Supplier, Subcontractor, Contractor, (CM) in making substitution request or in using an approved substitution represent:

- ☐ Has personally investigated the proposal and determined it is equal or superior in all respects to specified product, system or method and will perform intended function, except as stated above.
- ☐ Has same quality and life-cycle cost as design in the Contract Documents, except as stated above.
- ☐ Is in full compliance with applicable code requirements.
- ☐ Will provide same warranty for substitute item as for product, system or method specified.
- ☐ Will coordinate installation of proposal into Work, to include building modifications if necessary, making such changes as may be required for Work to be complete in all respects.
- ☐ Waive all claims for additional costs or time extensions related to proposal that subsequently become apparent or are caused by proposal.
- ☐ If a finish product, color wise and pattern wise complies with base specified items.
- ☐ Certifies cost data presented is complete and includes all related costs under this Contract, excluding Architect's review and redesign cost.
- ☐ Will pay Architect's review and redesign cost, special inspections, and other costs caused by proposal.
- ☐ Will pay additional costs to other contractors caused by proposal.
- ☐ Will modify other parts of Work as may be needed, to make all parts of Work complete and functioning.
- ☐ Acknowledge acceptance of these provisions.

List of Attachments: _____

ACKNOWLEDGEMENTS:

FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF PROPOSAL:

Requested by (firm):			
Acknowledged by (print & sign):		Date:	
Position:		Phone	
Subcontractor:			
Acknowledged by (print & sign):		Date:	
Position:		Phone	
Contractor:			
Acknowledged by (print & sign):		Date:	
Position:		Phone	

CONSTRUCTION MANAGER'S ACKNOWLEDGMENT AND RECOMMENDATION:

- ☐ Recommend approval for following reasons:
- ☐ Do not recommend approval for following reasons:
- ☐ Returned to requester - Need more information:

Comments: _____

Construction Manager: _____
Acknowledged by (print & sign): _____ Date: _____
Position:
Distribution: ☐ Architect ☐ file

ARCHITECT'S ACTION / RECOMMENDATION:

- ☐ Recommend Owner's approval.
- ☐ Submitted to Owner for authorization for Architect's as Change in Service to further evaluate and make recommendation.
- ☐ Submitted to Owner for authorization for Architect's as Change in Service to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Do not recommend (see comments below).
- ☐ Rejected:
  - ☐ Acceptance will require substantial revision of Contract Documents, building or systems.
  - ☐ Request does not indicate specific item, system or method which is being proposed.
  - ☐ Requested for manufacturer acceptance only.
  - ☐ Request form is not properly executed and signed.
  - ☐ Subcontractor or supplier requested directly.
  - ☐ Insufficient information submitted.
  - ☐ Does not comply color wise or pattern wise with base specified items.
  - ☐ Insufficient information submitted to evaluate.
  - ☐ Does not appear to comply with requirements of specifications for base specified product.
  - ☐ Other:
- ☐ Additional information needed - Returned to CM/Contractor for providing following:

Comments: _____

Architect: _____
By (print & sign): _____ Date: _____
Position: _____
Distribution: ☐Owner ☐CM/Contractor ☐file

OWNER ACTION:

- ☐ Reject - Do not want to consider.
- ☐ Product substitution approved - Contractor may proceed with request as a submitted.
- ☐ Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, and adjust Contract Sum and/or Contract time.
- ☐ Architect authorized as Change in Services to further evaluate and make recommendation.
- ☐ Architect authorized as Change in Services to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____
By: (print & sign) _____ Date: _____
Position: _____
Distribution: ☐ Architect ☐ CM/Contractor

ARCHITECT FURTHER ACTION / RECOMMENDATION (if needed):

- ☐ Incorporating into change document as directed by Owner. Change document _____ will be used.
- ☐ Recommend Owner's approval.
- ☐ Submitted to Owner for authorization for Architect's as Change in Service to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Do not recommend (see comments below).
- ☐ Rejected:
  - ☐ Acceptance will require substantial revision of Contract Documents, building or systems.
  - ☐ Request does not indicate specific item, system or method which is being proposed.
  - ☐ Requested for manufacturer acceptance only.
  - ☐ Request form is not properly executed and signed.
  - ☐ Subcontractor or supplier requested directly.
  - ☐ Insufficient information submitted.
  - ☐ Does not comply color wise or pattern wise with base specified items.
  - ☐ Insufficient information submitted to evaluate.
  - ☐ Does not appear to comply with requirements of specifications for base specified product.
  - ☐ Other:
- ☐ Additional information needed - Returned to CM/Contractor for providing following:
- ☐ Recommend Owner's approval.
- ☐ Do not recommend.

Comments: _____

Architect: _____

By: (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Owner ☐ CM/Contractor ☐ file

OWNER FURTHER ACTION (if needed):

- ☐ Reject - Do not want to consider.
- ☐ Product substitution approved - Contractor may proceed with request as a submitted.
- ☐ Approved – Architect directed as Change in Services to issue change document to incorporate substitution into contract Documents, and adjust Contract Sum and/or Contract time.
  Architect authorized as Change in Services to revised Contract Documents to incorporate proposal, and issue change document to the contractor for submitting a complete cost proposal for Owner's consideration.
- ☐ Additional information needed - Returned for providing following:

Comments: _____

Owner: _____

By: (print & sign) _____ Date: _____

Position: _____

Distribution: ☐ Architect ☐ CM/Contractor ☐ file

END OF FORMS

SECTION 01 25 13

SUBSTITUTION PROCEDURES AFTER EXECUTION OF CONTRACT

PART 1 - GENERAL

1.1 DEFINITION

A. Acceptable Manufacturers and Products: See Section 01 61 00.

B. Any product proposed by Contractor that does not meet requirements of the Contract Documents, whether in product characteristics, performance, quality, or manufacturer or brand names, is considered a substitution.

C. No substitutions will be considered:
   1. In case of non-availability of materials contact Architect for review and action.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION

SECTION 01 26 13
REQUESTS FOR INFORMATION (RFI)

PART 1 - GENERAL

1.1 SUMMARY

A. Section specifies administrative and procedural requirements for handling and processing Requests for Information (RFI).

B. RFI is intended for requesting clarifications and interpretations of Contract Documents due to apparent inconsistencies, errors or omissions in Contract Documents, and due to unanticipated existing conditions.

C. RFI is not intended for general communication, requesting substitutions, Contractor's proposed changes, resolution of nonconforming work, coordination between contractors or for general questions not related to Contract Documents.

D. RFI process is intended to be a cooperative effort between Architect and Contractor to expedite responses to RFIs and maintain progress of Work without utilizing other lengthy procedures.

E. Any other proposed method of processing RFI's other than indicated within this Section shall be evaluated by Architect for potential impact on Architect's services.
   1. If Architect agrees to utilize another proposed method, Architect will be reimbursed for any special training, usage fees, extra time required to implement, maintain, utilize and administer such a system.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 REQUESTS FOR INFORMATION

A. Review of Contract Documents and Field Conditions:
   1. Since contract Documents are complementary; before starting each portion of Work, Contractor shall carefully study and compare various Drawings, Specifications and other Contract Documents, coordination drawings, shop drawings, prior correspondence or documentation relative to that portion of Work, as well as information furnished by Owner.
   2. Contractor and Subcontractors shall evaluate and take field measurements of conditions related to that portion of Work and shall observe any conditions at site affecting it.
   3. These obligations are for purpose of facilitating coordination and construction by Contractor and are not for purpose of discovering errors, omissions, or inconsistencies in Contract Documents.
   4. Contractor and subcontractors acknowledge that all documents pertaining to Work has been examined, have examined character of site and any existing conditions, and are satisfied with nature of Work, and all other matters which can in any way affect Work.
   5. In event of inconsistency between portions of Contract Documents or within Contract Documents; provide better quality or greater quantity of Work, and comply with more stringent requirement, either or both in accordance with Architect's interpretation.
   6. Any errors, inconsistencies or omissions discovered in Contract Documents shall be reported promptly to Architect as a properly prepared and timely RFI.
   7. Contractor and Subcontractors are not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, but the Contractor shall promptly report to Architect any nonconformity discovered by or made known to Contractor as a RFI.

8. If Contractor or Subcontractor fail to give such notice, and knowingly proceeds with Work affected by errors or omissions in Contract Documents, Contractor shall correct any such errors, inconsistencies, or omissions at no additional cost.
9. Prior to the bid, Contractor shall review all existing facilities that are related to this contract and shall be familiar with all utility requirements and construction.
    a. Existing facility documents may be available through the Owner for review.
    b. Perform preliminary investigations as required to ascertain extent of Work.
    c. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.

B. Contractor's and Subcontractor's Responsibilities:
1. When interpretation, clarification or explanation of portion of Construction Documents is needed by Contractor, Subcontractor, Vendor or Supplier, the request shall be processed through Contractor.
    a. Review request for completeness, quality, proper referencing to drawing or specification section and reason submitted.
    b. If request is not acceptable it shall be returned to submitter with comments regarding reason for being returned.
    c. Make every attempt to validate, resolve or respond to RFI by thoroughly researching and reviewing Contract Documents and field conditions.
    d. Respond to RFI accordingly if review of RFI discloses a response or is related to coordination of construction or other issue not related to Contract Documents.
    e. If unable to respond to request, it shall be restated in clear, concise, correct, complete and easily understood manner, and rewritten if necessary, additional information included if necessary, and only then submitted to Architect for response.
2. Request for interpretation, clarification or explanation of Contract Documents shall be submitted to Architect through Contractor.
    a. List specific Contract Documents researched when seeking information being requested.
    b. Reference all applicable Contract Drawings by sheet number, section, detail, room number, door number, etc., Specifications by section and paragraph number, and reference any other relevant documents.
    c. The field titled "Regarding" on attached RFI form must be clear for future reference in reports or correspondence.
    d. Clearly state request and provide Contract Document references and any additional information needed so request can be fully understood, including sketches, photos or other reference material.
    e. Fully assess issues, suggest any reasonable solutions and include various factors, including potential costs, schedule impacts, if any, and recommendations which will aid in determining a solution or response. If a reasonable solution can not be suggested, a statement to that effect should be so stated.
    f. Indicate reason request is being submitted.
    g. Any critical RFI's requiring a rapid response shall clearly indicate such with an explanation as to why RFI is critical.
    h. Priority for responses shall be indicated when multiple RFI's are submitted within short period of time.
3. Copies of responses to RFI's shall be distributed to all parties affected.
4. A response to RFI shall not be considered a notice to proceed with a change that may revise the Contract Sum or Contract Time, unless authorized by Owner in writing.
5. If response to RFI is determined incomplete, it shall be resubmitted with reason response is unacceptable and any necessary additional information within five (5) days of time of receipt of response to RFI.

6. If Contractor determines or believes that additional cost or time is involved because of clarifications, interpretations or instructions issued by Architect in response to a RFI, resubmit RFI within five (5) days of receipt of response with reason and alternate solution or suggestion for performing work at no additional cost. If no other solution is possible or desirable, submit Claim in accordance with the Contract Documents with in twenty-one (21) days of receipt of response to the RFI.

C. RFI Submittal Process:
   1. RFI's shall be processed and submitted to Architect by Contractor utilizing HDR's Project Tracker Collaboration System (PTCS), a web based application.
      a. System is available through internet at http://PTCS.hdrinc.com.
      b. A unique user name and password will be assigned to Contractor for accessing system, project data and for submitting RFI's.
      c. The systems RFI module shall be utilized for submitting RFI's by Contractor..
      d. Entire question or requested information shall be inserted in "Request" portion of system.
      e. Electronic file of sketches, photos or other pertinent information may be uploaded with a RFI request in system to help clarify request.
      f. Upon submittal of RFI in system, current date will automatically be entered in system and an email notification will be sent to Architect.
      g. "Request" portion of screen or submitted date will not be able to be changed once RFI has been submitted. This is to protect submitted data from being altered.
      h. System will assign a unique RFI number in sequential order (1, 2, 3, 4, etc.).
      i. If a previously submitted RFI request needs to be revised to provide additional information, a new RFI will need to be initiated. The new RFI shall be renumber with previous submitted RFI number and then add ".1" for revision one (i.e.: RFI No. 34.1 for revision 1 to RFI No. 34).
   2. Submitted RFI's will be responded to by Architect utilizing HDR's Project Tracker Collaboration System.
      a. Architect may upload electronic files with RFI response in system to help clarify response.
      b. Upon response to RFI by Architect, the current date will be automatically entered into system and an email notification will be sent to Contractor indicating submitted RFI has been responded to.
      c. "Response" portion of screen or responded to date will not be able to be changed once RFI has been responded to. This is to protect response data from being altered.
   3. After receipt of an email notification that an RFI has been responded to, the system can be accessed for RFI response, any attachments and printing.
   4. Status of RFI's submitted and data regarding RFI's may be viewed or printed from system.
   5. RFIs and a variety of different RFI summaries, and filtered reports may be generated, viewed, printed or emailed from system.

D. Architect's Response to Request for Information (RFI):
   1. Clarifications, interpretations and decisions of Architect in response to RFI will be consistent with intent of and reasonably inferable from Contract Documents, and will be in writing, and if determined to be necessary by Architect, will be provided in form of drawings and other attachments or both.
   2. When making such interpretations and decisions, Architect will endeavor to secure faithful performance by both Owner and Contractor, will not show partiality to either and will not be liable for results of interpretations or decisions so rendered in good faith.
   3. Architect's decisions on matters related to aesthetic effects will be final if consistent with intent expressed in Contract Documents.
   4. Architect will not undertake to settle differences between Contractor, Subcontractors, trades suppliers, fabricator or manufacturer, or act as arbiter as to which Subcontractor, trade, supplier or manufacturer is to furnish or install various items indicated or required.

5. Architect shall provide responses to RFI's with reasonable promptness, but will endeavor to respond within twenty-one (21) days from date of receipt.
    a. If multiple RFI's are submitted on same day or within a five (5) day period, review time may be extended by mutual agreement of parties.
    b. Architect will provide a written response to RFI if Architect believes response only involves an interpretation, clarification, supplemental information or orders a minor change in Work not involving an adjustment in Contract Sum or extension of Contract Time, and is not inconsistent with intent of Contract Documents, and shall be binding.
    c. If Architect believes response may result in a change to Contract Sum or Contract Time, response will indicate that a change document will be issued for the response, and appropriate change document will be issued indicating changes to Contract Documents.
    d. Architect will provide any additional or supplemental drawings, specifications or other information as Architect may deem necessary to facilitate response.
6. Architect may return RFI without response for following reasons:
    a. Request is unclear or incomplete.
    b. Detailed information not provided.
    c. Is related to construction means, methods or techniques.
    d. Is related to health or safety measures.
    e. Is due to Contractor's lack of adequate coordination.
    f. Is for coordination between Subcontractors.
    g. Is considered a "Substitution Request."
    h. Is considered a "Contractor Proposed Change".
    i. Is due to non-conformance.
    j. Response is required by another party.

E. If requested information is available from careful study and comparison of Contract Documents, field conditions, other Owner-provided information, coordination drawings, or prior Project correspondence or documentation, Architect may invoice Owner as a change in services for costs involved in Architect's review, analysis, responding and processing of such RFI.
    1. Contractor shall reimburse Owner for such costs.

F. Contractor and Subcontractors may anticipate receiving 300 clarifications, interpretations, orders for Minor Changes in Work or responses to valid requests for interpretations or clarifications of Contract Documents.

END OF SECTION

SECTION 01 29 00

APPLICATIONS FOR PAYMENT AND SCHEDULE OF VALUES (GC)

PART 1 - GENERAL

1.1 SUBMITTALS

A. Project information:
   1. Submittals, prior to first application for payment:
      a. Copy of Executed Contract.
      b. Copy of Performance and Payment Bonds.
      c. Schedule of Values.
      d. Copy of Owner's Notice to Proceed.

B. Contract Closeout Information:
   1. See Section 01 77 00.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SCHEDULE OF VALUES

A. Prior to first Application for Payment, submit to Architect a Schedule of Values allocated to various portions of Work, prepared in such form and supported by such data to substantiate its accuracy as Owner and Architect may require.

B. At a minimum, subdivide into following allocated items:
   1. Bond.
   2. Insurance.
   3. General condition items: mobilization, temporary facilities, temporary utilities, submittals, demobilization, and other similar general condition items.
   4. Phases or areas or both of building.
   5. Provide individual fully separated schedule of values for all work related to Air Handler #20 scope.
   6. Specification sections.
   7. Individual components of Work, and major pieces of equipment.
   8. Labor amount and material or equipment amount, listed separately.
   9. Contract closeout items: manuals, spare parts, maintenance material, system demonstrations, record documents, operation and maintenance data, and other similar contract closeout items.
   10. Individually approved changes.

C. Labor amount shall include all on site installation costs including labor, applicable labor taxes, insurance, fringe benefits, erection equipment, tools, overhead and profit.

D. Material and equipment shall include all material and manufactured equipment costs including delivery costs, taxes, insurance, overhead and profit.

E. The schedule, unless objected to by Owner or Architect, shall be used as a basis for reviewing percent complete of line items on Contractor's Applications for Payments.

3.2 COST ESTIMATE FORECAST

A. Provide a cost estimate forecast by month for complete duration of Project for Owner information prior to first Application for Payment, update as needed.

3.3 APPLICATION FOR PAYMENT

A. On or before the first Tuesday of month, Contractor submit to Architect itemized Application for Payment for work completed during previous calendar month, in accordance with schedule of values.
   1. Submit on AIA Document G702 - Application and Certificate for Payment, and AIA Document G703 - Continuation Sheet, or similar format acceptable to Architect.
      a. Itemize in accordance with approved Schedule of Values, and as indicated in AIA documents.
      b. Bond and insurance costs may be requested for payment on first application.
      c. Equal monthly payments may be made for general conditions based upon number of months Contractor is scheduled to be on site.
      d. May include amounts for changes in work that have been authorized by Construction Change Directives, or by Change Proposal Requests approved by Owner.
      e. Furnish in triplicate.
      f. Signed by duly authorized agent of Contractor.
      g. Notarize Application for Payment.
   2. Furnish copies of requisitions from Subcontractors and suppliers to substantiate values.
   3. Shall not include request for payments for portions of Work for which Contractor does not intend to pay to a Subcontractor or supplier, unless such Work has been performed by others whom Contractor intends to pay.
   4. Provide additional supporting data substantiating Contractor's right to payment, as Owner or Architect may require.

B. Application for Payment serves as certification of status by Contractor of Project.

C. Contractor warrants that title to all Work covered by an Application for Payment will pass to Owner upon receipt of payment.

D. Contractor further warrants that upon submittal of an Application for Payment all Work for which Certificates for Payment have been previously issued and payments received from Owner shall, to the best of Contractor's knowledge, information and belief, be free and clear of liens, claims, security interests or encumbrances in favor of Contractor, Subcontractors, material suppliers, or other persons or entities making a claim by reason of having provided labor, materials and equipment relating to Work.

3.4 PAYMENT FOR STORED MATERIAL AND EQUIPMENT

A. Application for Payment may include materials and equipment ready, but not yet incorporated in Work, delivered, and suitably stored at site.

B. Warranty and guarantee period does not commence until Substantial Completion of work.

C. Payment will be treated same as "work-in-place," with evidence of delivery to job site, except that payments will not include value of labor and mark-up.

D. Each subsequent Application for Payment will restate prior month's materials and equipment not incorporated in Work, and current month additions and deletions for materials and equipment incorporated into work. Inventory must be updated and included with each subsequent application to indicate current status.

E. Upon making of partial payments by Owner, all materials and equipment covered thereby become sole property of Owner. Partial payments, however, do not constitute Owner's acceptance of material, equipment or work, nor be construed as waiver of any right or claim by Owner.

F. Contractor shall be deemed as having care, custody, and control of items.

3.5 RETAINAGE

A. Until Substantial Completion of entire project, 10 percent retainage will be withheld from value of Work completed and material stored.

B. Any reduction of retainage beyond that allowable by Contract Documents, and including adjustments at Substantial Completion requires Consent of Surety, recommendation of Architect, and approval of Owner prior to incorporating into an Application for Payment.
   1. Provide Request for Reduction of Retainage on form included herein and Consent of Surety; AIA Document G707A.
   2. If approved by Architect and Owner, Contractor may incorporate reduction in next Application for Payment.
   3. Include copy of approved form with Application for Payment.

END OF SECTION

STORED MATERIAL AND EQUIPMENT AFFIDAVIT

PROJECT: PROJECT NO:

ITEM N0.	QUANTITY	UNIT	MATERIAL OR EQUIPMENT DESCRIPTION	VALUE

LOCATION STORED: _____

IDENTIFICATION METHOD: _____

AFFIDAVIT:

Items listed above have been purchased exclusively for use on above referenced Project and have been received in good condition, and items are identified as property for use only on above referenced Project. Owner may enter upon premises for verification, inspection, or for any other purpose considered necessary. It is expressly understood and agreed that this affidavit is furnished to the Owner for purpose of obtaining approval for payment for said items, and that storage thereof at location indicated and payment by Owner shall not relieve Contractor of full responsibility for the protection, safeguarding, insurance, transporting, and proper installation at Project referenced above, and will warrant and defend against claims and demands of all persons. Upon making of partial payment by Owner, said items covered thereby become sole property of Owner.

Attached are receipted invoice(s), bills of sale(s), and/or other documents as evidence that Contractor is unconditional owner of said items, and they are free from all encumbrance, security agreements, mortgages or liens.

FROM CONTRACTOR: _____

BY: _____DATE: _____

SUBSCRIBED AND SWORN TO BEFORE ME THIS _____ DAY OF _____,_____.

NOTARY PUBLIC: _____ MY COMMISSION EXPIRES:

Owner (APPROVES) (DISAPPROVES) location of off site storage, and Contractor's inclusion of cost for above items in an Application for Payment.

OWNER'S APPROVAL:

BY: _____ DATE: _____

Contractor shall include this affidavit and other required documents with Application for Payment and shall maintain an inventory of all stored materials for submittal with future applications.

END OF FORM

STORED MATERIAL AND EQUIPMENT INVENTORY

PROJECT: FOR APPLICATION NO.:

PAGE: of

The following inventory represents our accounting of the current status of material and equipment in storage which we have received payment for:

ITEM NO.	MATERIAL OR EQUIPMENT DESCRIPTION	QUANTITY	VALUE	APPL. NO.	INCORPORATED DATE /QUANTITY	

FROM CONTRACTOR: _____

BY: _____ DATE: _____

This form shall be updated and submitted with each application for payment.

END OF FORM

REQUEST FOR REDUCTION OF RETAINAGE

PROJECT: PROJECT NO.:

CONTRACT FOR:

Contractor hereby requests that the percentage of partial payment retained by Owner under provision of contract be REDUCED to _____% for following reasons:

CONTRACTOR:

BY: _____DATE: _____

Power of Attorney and AIA Document G707A must be attached.

Architect (RECOMMENDS) (DOES NOT RECOMMEND) the reduction of retainage to _____%. Percentage of completion as of _____, _____ is _____%.

ARCHITECT:

BY: _____ DATE: _____

Owner hereby (APPROVES) (DISAPPROVES) reduction of retainage to _____%, and authorizes Architect to certify the reduction in an Application for Payment.

OWNER:

BY: _____ DATE: _____

If approved, Contractor may incorporate reduction in next Application for Payment, and shall include copy of this document with it.

DISTRIBUTION: ☐ OWNER ☐ ARCHITECT ☐ CONTRACTOR

END OF FORM

SECTION 01 31 19
PROJECT MEETINGS

PART 1 - GENERAL

1.1 PREBID CONFERENCE

A. Prebid conference: See Section 00 21 13, Instructions to Bidders.

1.2 PRECONSTRUCTION CONFERENCE

A. Architect schedule and hold preconstruction conference prior to construction.

B. Attendance:
   1. Owner:
      a. Project representative.
      b. Director of Operations or Engineering.
   2. Architect.
   3. Contractor:
      a. Home office representative.
      b. Field Project Manager.
   4. Construction Manager:

C. Contractor must be prepared to discuss, as a minimum, following items:
   1. Contractor distribute and discuss:
      a. List of subcontractors.
      b. Tentative construction schedule.
         1) Start and completion dates.
         2) Critical work sequence.
   2. Status of Contract, bonds, and insurance.
      a. Accepted alternates.
   3. Procedures.
   4. Designation of responsible personnel.
   5. Processing of field decisions and change orders.
   6. Submittal process.
   7. Procedures for maintaining record documents.
   8. Use of premises:
      a. Office and storage areas.
      b. Owner’s requirements.
   9. Submission and processing of monthly Application for Payment and associated requirements.
   10. For projects requiring demolition of existing structures address removal and disposal of hazardous materials and toxic substances as applicable.

D. Contractor to have meeting with subcontractors after preconstruction conference to discuss procedures.

1.3 CONTRACTOR MEETINGS

A. Conduct weekly progress, coordination and scheduling meetings with subcontractors.

1.4 PROGRESS MEETINGS

A. Attend scheduled meetings; time, day and place to be determined.
   1. Generally, meetings will be held monthly or as required by progress of the Work and scheduled to coincide with Architect’s regular scheduled site visits.
   2. Meetings to be held at job site or as arranged.

3. Contractor administer meetings and record minutes.

B. Attendance:
1. Owner's Representative.
2. Architect's Representative.
3. Contractor:
   a. Home office representative.
   b. Field Project Manager.
   c. Superintendent.

C. Minimum Agenda:
1. Review, approve minutes of previous meeting.
2. Review work progress since last meeting.
3. Planned progress during next work period.
4. Review construction schedule.
5. Identify concerns which impede planned progress.
6. Note field observations, questions, and decisions.
7. Review submittal schedules.
8. Review Owner/Contractor coordination items.
9. Review status of changes.

1.5 PREINSTALLATION CONFERENCE

A. Convene affected parties for coordination where required by Contract Documents.
1. Conduct meetings prior to installation of the Work.
2. Meetings to be held at job site or as arranged.

B. Contractor administer meetings and record minutes.

C. Attendance:
1. Owner's Representative.
2. Architect's Representative.
3. Contractor:
   a. Field Project Manager.
   b. Superintendent.
   c. Fabricator or Supplier.
   d. Installer.
   e. Others whose work may affect or be affected by installation.

D. Suggested Agenda:
1. Review or inspect existing conditions.
2. Review submittals.
3. Review construction schedule and identify concerns.
4. Review Owner/Contractor coordination items.
5. Discuss mobilization and delivery.
6. Note field observations, questions, and decisions.

END OF SECTION

SECTION 01 31 26
PROJECT TRACKER COLLABORATION SYSTEM REQUIREMENTS

PART 1 - GENERAL

1.1 DEFINITIONS

A. Project Tracker Collaboration System (PTCS): HDR's web-based Project Tracker Collaboration System will be utilized on this Project for collaboration and certain administrative functions.

1.2 PROJECT TRACKER COLLABORATION SYSTEM

A. PTCS is a web-based application furnished by Architect at no cost to Owner and Contractor.

B. Contractor will have access to projects and modules for which they have permissions.

C. Architect will manage and administer PTCS.

D. Provides high-speed shared access via internet to data.

E. Enables project team to review status of documents and generates a variety of reports which can be filtered by different criteria.

F. Allows uploading, viewing and printing of multiple documents and attachments in most modules.

G. Certain documents will be distributed by Architect by means of PTCS.

H. Email notifications capabilities within PTCS with attachments or link to PTCS record.

I. PTCS Help Guide is available from application.

1.3 HARDWARE REQUIREMENTS

A. Computer with high-speed internet connection.

1.4 SOFTWARE REQUIREMENTS

A. Operating System: Windows XP, minimum.

B. Web Browser such as Internet Explorer v7, minimum, to access PTCS.

C. Adobe Acrobat or Bluebeam PDF to view reports and PDF documents generated by PTCS.

D. Additional applications: MS Word, MS Excel, imaging software to open DOC, XLS, TIFF and JPEG attachments.

E. Email application and service.

1.5 ACCESSING HDR PROJECT TRACKER COLLABORATION SYSTEM

A. HDR will assign each required external user a temporary password to access PTCS. User will need to change temporary password.

B. From a web browser such as Internet Explorer v7 or higher, access HDR's Project Tracker Collaboration System website: http://ptcs.hdrinc.com.

C. External user logging in to PTCS: PTCS will prompt to login with email address and *password.*
   1. Password is case sensitive.

D. Cautions:
   1. Session will expire if computer is idle for approximately 2 hours while in PTCS.
   2. Periodically Save any entered data so it is not lost.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 MODULES / FUNCTIONS

A. Contractor will utilize following PTCS modules:
   1. Verify with HDR's project Construction Contract Administrator which PTCS modules will be made available to contractor and the document nomenclature which will be used. Submittals:
      a. Samples and Project Information that requires professional seals and signatures shall not be submitted electronically.
      b. Other Submittals: Contractor to submit electronically:
         1) Submit as PDF documents.
         2) Recommended file creation: 200 DPI minimum, 400 DPI maximum scan test in test mode. Scan images with test in test/photo mode.
         3) Include executed HDR Submittal Transmittal form with submittal.
         4) Name PDF file same as Submittal Number. i.e.: 063420-1A.pdf
         5) Do not submit file in Adobe PDF/A mode.
         6) Transmitting submittal files to Architect:
            a) Utilize PTCS:
               (1) Select assigned project utilized for submittal transmittal.
               (2) Select MODULES tab and then select Submittal module to open submittal list screen
               (3) From list screen select specification section in the pull down menu adjacent to the "New" button, then click the new button to open a new detail screen.
               (4) From detail screen enter information in fields regarding submittal.
                  (a) Fields with asterisks are required to be completed.
                  (b) Upload file of submittal.
                  (c) Acknowledgement that the contractor has complied with requirements of the contract documents is mandatory.
                  (d) The submit button will only become available if all required fields are filled out.
               (5) HDR's Submittal Admin will be automatically notified that a submittal has been submitted by the contractor and is ready for designers' review and action in accordance to contract documents. No further action is required by the contractor until they received notice that the reviews are complete.
      c. Architect will notify Contractor by email when submittals have been reviewed and posted to PTCS.
      d. Contractor will access PTCS to download electronic submittal image file for further processing.
      e. See Section 01 33 00 - Submittal Processing for additional requirements.
   2. Communication:
      a. Architect will notify Contractor by email when communication such as Meeting Minutes, Site Visit Reports, etc. are posted to PTCS.
      b. Contractor will access PTCS to access communication.
   3. Request for Information (RFI):
      a. Contractor shall create new RFI's in PTCS for requesting information from Architect. Architect will receive automatic email notification when submitted.
      b. Architect will access PTCS to access requested information and any attachments. Contractor will receive automatic email notification when Architect responds.
      c. Contractor will access PTCS to view response and any attachments.

   d. See Section 01 26 13 - Request for Information Process for additional information.
4. Information Requests (IR):
   a. Architect may create new IR's in PTCS for requesting information from Contractor. Contractor will receive automatic email notification when Architect submits.
   b. Contractor will access PTCS to view requested information and any attachments, and will respond in a timely manner.
   c. Architect will access PTCS to view response and any attachments.
5. Change Proposal Requests:
   a. Architect will notify Contractor by email when document has been issued and posted to PTCS.
   b. Contractor will access PTCS to download electronic documents for further processing.
   c. See Section 01 23-04 – Changes in Work for additional information on processing changes.
6. Clarification – Interpretations (C-I):
   a. Architect will notify Contractor by email when document have been issued and posted to PTCS.
   b. Contractor will access PTCS to download electronic documents for further processing.
   c. See Section 01 23-04 – Changes in Work for additional information on processing changes.
7. Construction Change Directives (CCD):
   a. Architect shall notify Contractor by email when document has been issued and posted to PTCS.
   b. See Section 01 23-04 – Changes in Work for additional information on processing changes.

END OF SECTION

SECTION 01 31 33
MECHANICAL AND ELECTRICAL SUBMITTAL COORDINATION

PART 1 - GENERAL

1.1 SUMMARY

A. Special coordination of mechanical and electrical construction with respect to finished ceilings, structural components and other building elements.

1.2 COORDINATION DRAWINGS

A. Prepare coordination drawings in accordance with Section 01 78 39.

B. Show work of trades indicated with specific emphasis on timing of installation, layout, and vertical and horizontal space requirements.

C. Scale Drawings: 1/4 IN = 1 FT or larger if required.

D. At points of apparent conflict, draw sections to show relationship of various elements to the ceiling plane and building structure. Each trade shall be coordinated with other trades in order to provide complete and coordinated layouts.

E. Each Contractor shall review and sign final drawings indicating approval.

F. Work to be shown:
   1. Structural framing system.
   2. Lighting fixtures.
   3. Ductwork.
   4. Sprinkler piping heads.
   5. Plumbing and HVAC piping above the ceiling.
   6. Conduit runs 1 IN and greater in size.
   7. Walls extending up to structure.
   8. Finished ceilings.
   9. Others as required whose work falls within these affected physical limitations.

G. Coordination drawings shall not supplant the requirements specified elsewhere for shop drawings, unless trades involve indicate that coordination drawings are sufficient for fabrication purposes, and so state in writing.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION – NOT USED

END OF SECTION

SECTION 01 32 16
CONSTRUCTION SCHEDULES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Includes:
   1. Contractor, promptly after being awarded the Contract, shall prepare and submit for Owner's and Architect's information a Contractor's construction schedule for the Work. Schedule shall not exceed time limits current under Contract Documents, shall be revised at appropriate intervals as required by the conditions of the Work and Project, shall be related to entire Project to extent required by Contract Documents, and shall provide for expeditious and practicable execution of Work.
   2. Coordinate Subcontractors' schedules for entire Project:
      a. Secure time commitments for performing critical elements of Work from parties involved.
      b. Coordinate each element on the schedule with other construction activities; include minor elements involved in sequence of Work.
      c. Show each activity in proper sequence.
      d. Indicate graphically the sequences necessary for completion of related portions of Work.
      e. Resolve conflicts among schedules of Subcontractors.
      f. Revise as required by conditions and progress of Work.
      g. Furnish copy of schedules for entire Project to each Subcontractor.
      h. Coordinate with Section 01 50 00; Construction Facilities, Temporary Controls and Utilities.
   3. Contractor shall perform Work in general accordance with most recent schedules submitted to Owner and Architect.

1.2 SUBMITTALS

A. Project information:
   1. Preliminary Construction Schedule:
      a. Provide to Owner and Architect prior to start of Work, but not later than date set for preconstruction conference.
   2. Project Schedules:
      a. Provide to Owner and Architect within 60 days of start of construction.
   3. Updated Project Schedules:
      a. Provide to Owner and Architect quarterly.
      b. Provide if completion date is revised or sequence of Work is revised.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 FORM OF SCHEDULES

A. Horizontal Bar Chart:
   1. Provide separate horizontal bar column for each line item of the approved Schedule of Values.

2. Indicate each bar with start and completion date of each item, its total dollar value percent to be completed for each month.
3. Identify each bar column:
   a. By specification section number, Work element and major component.
   b. By distinct graphic delineation.
4. Horizontal time scale: Identify first week day of each week.
5. Scale and spacing: To allow space for updating.
6. As Work progresses, place contrasting mark in each bar to indicate actual progress and completion.

B. Sheet Size:
   1. Maximum 11 x 17 IN.

C. CPM Schedule:
   1. Furnish a CPM schedule covering items of construction with, as a minimum, early/late start and early/late finish and normal float.

3.2 CONTENT OF SCHEDULES

A. Provide complete sequence of construction by activity.
   1. Shop drawings, product data and samples:
      a. Submittal dates as indicated in approved Submittal Schedule.
      b. Dates reviewed copies will be required.
   2. Decision dates for:
      a. Selection of finishes.
   3. Product procurement and delivery dates.
   4. Dates product information and delivery of Owner furnished, installed equipment and materials is needed.

B. Dates for early and late beginning, and completion of each element of construction.

C. Identify Work of separate floors, or separate phases, or other logically grouped activities.

D. Show how requirements for phased completion and partial occupancy by Owner affect sequence of Work.

E. Indicate important stages of construction for each major portion of Work, including submittal review, testing, and installation.

F. Identify punch list preparation and completion durations, agencies inspections, and Owner occupancy dates.

G. Show projected percentage of completion for each item of Work as of last day of every month.

H. Identify restraints and constraints.

I. Identify critical path and critical portions of entire schedule. There shall be only one critical path and it shall be clearly identified.

3.3 UPDATING

A. Show changes occurring since previous submission of updated schedules.

B. Indicate progress of each activity, actual verses scheduled start and completion dates, and actual verses scheduled percent complete by month.

C. Include:
   1. Major changes in scope.
   2. Activities modified since previous updating.
   3. Review projections due to changes.
   4. Other identifiable changes.

D. Provide Narrative report Including:
   1. Discussion of problem areas including current and anticipated delay factors and their impact.
   2. Corrective action taken or proposed and its effect.
   3. Effect of change in schedule.
   4. Description of revisions.
      a. Effect on schedule due to changes to Contract.
      b. Revisions in duration of activities.
      c. Other changes that may affect schedule.

3.4 DISTRIBUTION

A. Distribute copies of revised schedules to:
   1. Owner.
   2. Architect.
   3. Contractors/Subcontractors.
   4. Other concerned parties.

B. Instruct recipients to report inability to comply and provide detailed requirements and schedule, with suggested remedies.

END OF SECTION

SECTION 01 32 26
PROGRESS REPORTS AND PHOTOS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Work Includes:
   1. Compilation and submission of monthly progress reports.
   2. Taking and submission of monthly progress photographs.

1.2 SUBMITTALS

A. Project Information:
   1. Progress report:
      a. Submit monthly prior to or with Application for Payment.
         1) Written portion of report shall be in Microsoft Word format.
   2. Progress Photos:
      a. Submit digital photographs electronically. See Section 01 31 26 Project Collaboration System Requirements.
   3. Contract Closeout:
      a. Provide two (2) indexed sets of compact disks (CD) of digital progress photographs.

1.3 PROGRESS REPORTS

A. Each Subcontractor shall prepare comprehensive Daily Log and maintain it during entire project period. Submit copy to Contractor for compilation into monthly Progress Reports.

B. Progress report to include following Summary narrative for entire month.
   1. Current total percent complete.
   2. Current percent complete of major work activities.
   3. Percent of work completed during past month.
   4. Main work activities completed during prior month.
   5. Main work activities in process and scheduled for next month, including major equipment deliveries, system tie-ins and system start-ups.
   6. Overall status of project compared with project schedule.
   7. Delays or potential delays, if any.

C. Daily logs to include following data for each day of prior month.
   1. Manpower, by trade.
   2. Work performed, with location.
   3. Weather.
   4. Situations or circumstances which could delay work or give cause for claims for extension of time or added cost.
   5. List of visitors names, to include officials, Owner's representatives, and other authorities.

1.4 PROGRESS PHOTOGRAPHS.

A. General:
   1. Include digital progress photographs on compact disk (CD).
   2. Digital camera requirement:
      a. Minimum 10 megapixels resolution.
      b. GPS geo-tagging capable.
   3. Photograph format: JPEG format and file extension with 1600 by 1200 pixels, minimum.
   4. Digitally date photographs.

B. Identify photographs with project name, date, direction, and view or vantage point.

C. Photograph/file naming: Include date (YRMODY), Building or Area, Direction photo taken (N.S.E.W.), and Description of Subject.
   1. File name example: 07 04 12_Area-A1_NE_AHU-6.jpeg.

D. Provide index of submitted digital photos.

E. Building Interior: Minimum 48 digital photos monthly until project interior is finished, taken from different view points of interest, related to current progress.

END OF SECTION

SECTION 01 33 00
SUBMITTAL PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. This Section specifies administrative and procedural requirements for handling and processing Shop Drawings, Product Data, Samples, Project Information submittals including Contract Closeout submittals.

B. Provisions of this Section take precedence over provisions in General Conditions of the Contract for Construction governing Shop Drawings, Product Data, Samples, Project Information and Contract Closeout Information submittals.

C. Submittals are not to be used as means for substitution requests.
   1. Submittals that include substitutions will be returned without review or action.

D. Contact Architect in event of non-availability of specified product due to strikes, lockouts, bankruptcy, production discontinuance, proven shortage, or similar occurrences.
   1. Notify Architect, in writing, with substantiating data as soon as non-availability becomes apparent.
   2. Notify in time to avoid delay in construction.

E. Appropriateness and accuracy of calculations is responsibility of Contractor, and Contractor's Professional Structural Engineer when such calculations are required to be professionally sealed.

F. When professional or other certification of performance criteria of materials, systems or equipment is required by Contract Documents, Architect shall be entitled to rely upon accuracy and completeness of such calculations and certifications.

1.2 DEFINITIONS

A. General:
   1. Submittals are not Contract Documents.
   2. Purpose of submittals is to demonstrate way by which Contractor proposes to conform to information given and design concept expressed in Contract Documents for those portions of Work for which Contract Documents require submittals..

B. Shop Drawings Action Submittals:
   1. Drawings to scale, diagrams, schedules and other data specially prepared for Work by Contractor or a Subcontractor, sub-subcontractor, manufacturer, supplier or distributor to illustrate some portion of Work.

C. Product Data Action Submittals:
   1. Illustrations, standard schedules, performance charts, instructions, brochures, color charts, performance curves, diagrams, test data and other information furnished by Contractor to illustrate material, product, equipment or system for some portion of Work.

D. Samples Action Submittals:
   1. Physical examples which illustrate size, kind, pattern, texture, materials, equipment, systems or workmanship and establish standards by which Work will be judged.
   2. Samples also include job site Mock-ups and sample construction.

E. Project Information Submittals:
   1. Examples of Information Submittals, which do not require review or action by Architect, include but are not limited to;
      a. Progress Reports

b. Contractor Coordination Drawings
c. Bonds.
d. Construction Schedules.
e. Manufacturer's Installation or Adjustment Instructions.
f. Statements of Qualifications.
g. Certificates.
h. Field Service, Laboratory Test.
i. Start-Up Reports,
j. Design Calculations.
k. Material Safety Data Sheets.
l. Safety Programs and Reports.
m. Other Information Submittals identified in individual specification sections.

F. “Contract Closeout Information” Submittals:
1. Items pertaining to quality control and Owner information, which are required at Substantial or Final Completion, and do not require review or action by Architect.
2. Architect may review at its sole discretion, for general compliance with Contract Documents only.
3. Review will not constitute a detailed check of submitted design calculations.
4. Examples of Contract Closeout Information Submittals, which do not require review or action by Architect, include but are not limited to Pre-occupancy test reports.
a. Operation and Maintenance Data.
b. Warranties and Guarantees
c. Owner instruction reports.
d. Project Record documents.
e. Extra materials or tools.
f. Other Submittals identified in individual specification sections.

G. Acceptable Manufacturers and Products, Base and Optional: See Section 01 61 00.

1.3 SUBMITTALS REQUIRED BY THIS SECTION

A. Project information:
1. Schedule of Submittals: Provide sufficiently in advance of transmittal of first submittal and prior to first application for payment.

1.4 SCHEDULE OF SUBMITTALS

A. Complete Schedule of Submittals shall include Shop Drawings, Product Data, Samples, Project Information, and Contract Closeout Information required by specification section Submittal paragraphs.
1. Submittals Schedule shall be mutually agreed upon, in writing, by Architect and Contractor.
2. Contractor or Subcontractors may require submittals for their coordination purposes even when submittals are not required by Contract Documents for Architect’s review. Do not include or submit such submittals to Architect.
3. Schedule shall be in horizontal bar chart format divided by weeks indicate proposed submittal dates for each submittal.
4. Schedule shall allow for adequate time to perform orderly and proper review of submittals, including time for consultants and Owner if required and resubmittals by Contractor if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
a. Allow at least two weeks for Architect’s review and processing of each submittal, excluding mailing.
5. Coordinate each submittal with fabrication purchasing, testing, delivery, other submittals and related activities that require sequential activity.
6. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.

7. Architect reserves the right to withhold action on a submittal which, in the Architect's opinion, requires coordination with other submittals until related submittals are received, and will notify the Contractor, in writing, when he exercises this right.
8. Do not include or submit items not required to be submitted by Contract Documents.
9. Arrange submittals by specification section:
    a. Submittals shall include items from one specification section only.
    b. Submit Shop Drawings, Product Data, and Project Information (except for Field Test Reports) items specified in a section at same time for a complete review.
        1) Shop Drawings: Individual submittal item. Subparagraphs represent description of items to include.
            a) Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
        2) Product Data: Individual submittal item. Subparagraphs represent description of items to include as part of single submittal.
        3) Sample and Information submittals: Each subparagraph represents an individual submittal item.
10. Indicate submittals that will be provided to agencies having jurisdiction. Schedule sufficiently in advance of date required to allow agency reasonable time for review, and Contractor resubmission if necessary, and to cause no delay in Work or in activities of Owner or other contractors.
11. Indicate additional submittals that will be generated as result of dividing required submittal by building, floor, area of a floor, or other subdivision.
12. Submit all submittals required by a section at same time which are needed for a complete review, except Contract Closeout Information Submittals, and Shop Drawing submittals divided by building area, such as; structural steel, reinforcing steel, HVAC ductwork, etc.
13. Do not submit large quantities of submittals at one time.
14. Schedule Contract Closeout Information submittals during last quarter of construction period and prior to Substantial Completion.
15. Partial payment requests may be withheld until satisfactory Schedule of Submittals has been received.

1.5 SHOP DRAWINGS

A. Shop Drawing Action Submittals are required as called for in each specification section Submittal paragraph.
    1. Do not use Contract Drawings as Shop Drawings.

B. Submit high quality, high contrast copy of Product Data in Portable Document Format (PDF).
    1. Utilizing Project Tracker Collaboration System (PTCS). See Section 01 31 26 for specific information.

1.6 PRODUCT DATA

A. Product Data Action Submittals are required as called for in each specification section Submittal paragraph.

B. Submit high quality, high contrast copy of Product Data in Portable Document Format (PDF).
    1. Utilizing Project Tracker Collaboration System (PTCS). See Section 01 31 26 for specific information.
    2. Include index if multiple items under specification section are included in submittal.
    3. Mark each copy to show exact item, model, and options submitted for review.
    4. Show compliance with specified reference standards, performance characteristics, and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions; and required clearances; notation of coordination requirements.
    5. Mark through items on manufacturer's standard sheets which are not being proposed. Submittals without indications and deletions will be returned without review.
    6. Include scale details, sizes, dimensions, performance characteristics, capacities, wiring diagrams, controls and other pertinent data.

1.7 SAMPLES

A. Sample Action Submittals are required as called for in each applicable specification section Submittal paragraph.
   1. Identify samples with manufacturer's name, item, use, type, Project designation, specification section or drawing, detail reference, color, range, texture, finish and other pertinent data.
   2. Send samples to address indicated, or Project site if required or requested.
   3. Samples shall have a label affixed or attached thereto of sufficient size to accommodate Contractor's approval stamp.
   4. Submit two samples of each.
   5. Architect may retain one sample for comparison purposes.

B. When specific colors, textures, or patterns are not specified, submit samples from full range of manufacturer's standards for selection. When custom or standard finishes are specified, submit samples of specified colors, textures or patterns.

1.8 PROJECT INFORMATION AND CONTRACT CLOSEOUT INFORMATION

A. Project Information and Contract Closeout Information submittals are required as called for in each specification section Submittal paragraph.

B. Submit high quality, high contrast copy of Product Data in Portable Document Format (PDF).
   1. Utilizing Project Tracker Collaboration System (PTCS). See Section 01 31 26 for specific information.

1.9 SUBMITTALS REQUIRING PROFESSIONAL SEALS AND SIGNATURES

A. Shall be submitted per following:
   1. Unless otherwise agreed to by Architect, submit to Architect's for records one (1) original, or high quality high contrast copy of submittal suitable for reproduction, unless quantity is indicated elsewhere. Submit quantity indicated in specifications sections to Owner.
   2. Architect is not required to return submittal.
   3. Do not fold. Submit in envelope large enough for submitted items.

1.10 TRANSMITTAL – GENERAL

A. Contractor is responsible for making submissions.
   1. Electronic submittals shall be submitted utilizing web-based Project Tracker Collaboration System. See Section 01 31 26 for specific information.
   2. Samples and submittals which require hard copies, submit items to office of Architect:

      HDR Architecture, Inc.
      8404 Indian Hills Drive
      Omaha, NE 68114-4098
      Attention: Jeff Pauba

B. Transmit items with Submittal Transmittal form included at end of this section, or supplied by Architect, or similar format approved in advance by Architect.
   1. If submittal is based on an Optional manufacturer listed in Part 2 of technical specification sections, in lieu of Base manufacturer listed, submit completed form titled Optional Manufacturer Product/System Comparison included at end of this section along with Submittal Transmittal form.
      a. Optional Manufacturer Product/System Comparison form is not required to be submitted if Optional manufacturer product name and product or model number is specifically listed in technical specification sections.
   2. Contact Architect for copy made for Project.

3. Indicate Project name, Architect's project number, specification section title, description of submitted items or systems, manufacturer and submittal type on transmittal form.
4. Indicate submitted date, approval and sign in appropriate space on transmittal form.
5. Submittal Transmittal form shall stay with submittal throughout its routing.
6. Indicate submittal number in space provided on Submittal Transmittal form. Following submittal numbering system shall be used:
   a. Identify each submittal using applicable 5 or 6 digit specification section number from Contract Documents.
   b. After section number, indicate sequence number. First submittal of section series would be numbered "######-1", next would be "######-2", etc.
   c. If returned for re-submission, add a designation character. Second submission would be "######-1A", third would be "######-1B", etc.
7. Indicate description of submitted items including drawing numbers, etc.
8. Indicate "Submittal type" being submitted.

C. Submittals shall only include items from one specification section.
   1. Project Information Submittals and Contract Closeout Information Submittals shall be submitted separately from other submittals required by specification section.
   2. Submit all items specified in section at same time for complete review, except Contract Closeout Information Submittals.

D. Do not submit following:
   1. Submittals not required by specification section Submittal paragraph.
   2. Submittals required by other contractors or trades for their coordination that are not required by specification section Submittal paragraph.
   3. Submittal of products, systems or manufactures not specified.
   4. Submittal of substitution.
   5. Submittal of MSDS information.
   6. Large quantities of submittals at one time.

E. Do not mark copies with highlighters that black out information, or turn opaque when reproduced, or will not scan or reproduce legibly.

1.11 CONTRACTOR AND SUBCONTRACTOR ACTION

A. Submit submittals required by Contract Documents in accordance with submittal schedule approved by Architect or, in absence of an approved submittal schedule, with reasonable promptness and in such sequence as to cause no delay in Work or in the activities of Owner or of separate Contractors.

B. Direct specific attention in writing with submittal or on submittal, indicating deviations from requirements of Contract Documents.
   1. Contractor shall not be relieved of responsibility for any deviation from requirements of Contract Documents by Architect's approval of submittals unless,
      a. Contractor has specifically informed Architect in writing of such deviation at time of submission, and
      b. Architect has given written approval to specific deviation as a minor change in Work, or
      c. a Change Order or Construction Change Directive has been issued authorizing the deviation.
   2. Contractor shall not be relieved of responsibility for errors or omissions in Shop Drawings, Product Data, Samples or similar submittals by the Architect's approval thereof.
   3. Completed Work shall match appearance of approved samples and mock-ups.

C. Contractor represents and warrants that submittals shall be prepared by persons and entities possessing expertise and experience in the trade for which submittal is prepared, and if required by Architect or applicable law, by a licensed Professional Engineer or Structural Engineer, or other specialized Engineer, where so stipulated.

D. Contractor is responsible for confirmation and correlation of dimensions at Project site; for information that pertains solely to fabrication processes or to techniques of construction; and for coordination of work of trades.

E. Contractor and Subcontractor shall review submittal required by Contract Documents for compliance with Contract Documents, approve and submit to Architect.

F. Submittal to Architect indicates Contractor, Subcontractor represent they have:
   1. Reviewed submittal for compliance with the Contract Documents and has approved submittal;
   2. Determined and verified field measurements, and field construction criteria related thereto, or will do so;
   3. Determined and verified quantities, materials, performance criteria, installation requirements, catalog numbers and similar data related thereto;
   4. Determined substitutions have not been included;
   5. Checked, determined, verified and coordinated information contained within such submittals with requirements of Work, Contract Documents and other submittals;

G. Resubmit items returned by Architect and marked “Revise and Resubmit” or “Not Approved” until approval is received.
   1. Direct specific attention, in writing, or on resubmitted submittals to revisions other than those requested by Architect on previous submittals.
   2. In the absence of such written notice, the Architect’s approval of a resubmission shall not apply to such revisions.
   3. Bubble or otherwise clearly identify all changes from previous submittal.
   4. Tag each re-submittal with a designation that reuses the previous submittal number and a suffix designating the re-submittal sequence in accordance with the numbering system indicated in this section.

H. Contractor shall reproduce and distribute copies of submittals after Architect’s review to:
   1. Project site: Copy of “Approved” or “Approved as Noted” submittals for use by Contractor’s field staff, Owner and Architect’s representatives.
   2. Subcontractor/vendor.
   3. Other Contractors, Subcontractors or vendors as may be required for coordination purposes.
   4. Owner: Copy of “Approved” or “Approved as Noted” submittals.
   5. Authorities having jurisdiction: Copy of “Approved” or “Approved as Noted” submittals if required by Authority Having Jurisdiction (AHJ).
   6. Inspector (if any): Copy of “Approved” or “Approved as Noted” submittals.
   7. Testing and Inspection Agencies: Copy of “Approved” or “Approved as Noted” submittals required for them to perform inspections and testing.

I. Contractor shall not be relieved from responsibility for coordination with other submittals or for errors or omissions in submittals by Architect’s approval thereof.

J. Material lists and quantity information included in submittals are sole responsibility of Contractor.

K. Where a submittal is required by Specifications, any related Work performed prior to Architect’s review and approval of the pertinent submission will be sole expense and responsibility of Contractor.

1.12 ARCHITECT ACTION ON SUBMITTALS

A. Architect’s action on submittals:
   1. "APPROVED": Submittal is in general conformance with the design concept of Project and in general compliance with information given in Contract Documents.
   2. "APPROVED AS NOTED": Submittal has minor issues. Noted corrections must be made in final installation. Architect has option to require re-submission for record.
   3. "REVISE AND RESUBMIT": Re-submission is required, due to nature or number of issues.

4. "NOT APPROVED": Submittal does not meet contract requirements or is not required to be submitted..
5. “NO ACTION REQUIRED BY ARCHITECT”: Submittal not required, Project Information or Contract Closeout Information Submittal

B. Architect will review and approve or take other appropriate action upon Contractor’s submittals, but only for limited purpose of checking for conformance with information given and design concept expressed in Contract Documents.
   1. Such review and action is limited to only those submittals identified in Contract Documents.
   2. Architect’s review of such submittals is not conducted for purpose of determining accuracy and completeness of other details and information such as dimensions, quantities, or for substantiating instructions for installation or performance of equipment or systems, all of which remain responsibility of the Contractor.
   3. Architect’s review or approval of a specific item shall not indicate approval of an assembly of which the item is a component.
   4. Architect’s review or approval shall not constitute a review of safety or health precautions, or of any construction means, methods, techniques, sequences or procedures.
   5. Architect’s review or approval on a resubmission shall not apply to revisions that Contractor has not directed specific attention to in writing on resubmitted submittals, other than those requested by Architect on previous submittal.

C. Architect’s action will be taken with such reasonable promptness as to cause no delay in Work or in activities of Owner, Contractor or separate contractors, while allowing sufficient time in Architect’s professional judgment to permit adequate review by Architect, Architect’s consultants, and Owner, if needed.
   1. Architect’s obligation to review or approve submittals and to return them with reasonable promptness is conditional upon prior review and approval of submittals by Contractor, and Contractor’s transmittal of submittals in accordance with Contract Documents and approved Schedule of Submittals.

D. Items not submitted in accordance with provisions of this section may be returned, without review or action.
   1. Submittals which do not indicate Contractor has reviewed submittal for compliance with Contract Documents, and approved submittal.
   2. Submittals which are not required by Contract Documents.
   3. Submittal on items not approved for use by Contract Documents.
   4. Submittals which include information from more than one specification section.
   5. Project Information Submittals or Contract Closeout Information Submittals included with other submittals required by specification section Submittal paragraph.
   6. Submittals required by other contractors or trades for their coordination that are not required by specification section Submittal paragraph.
   7. Submittal of products, systems, or manufactures not specified.
   8. Submittal of substitution.
   9. Submittal of MSDS information.
   10. Information on only a portion of a submittal.
   11. If approved Submittal Transmittal form was not used.

E. If a submittal must be delayed for coordination with other submittals not yet submitted, Architect may, as an option, either return submittal with no action or notify Contractor of other submittals which must be received before submittal will be reviewed.

F. Additional copies of submittals not required or requested may not be returned.

G. Architect may review Project Information Submittals or Contract Closeout Information Submittals at its sole discretion, for general compliance with design concept expressed in Contract Documents.

H. Architect will return submittal utilizing Project Tracker Collaboration System (PTCS) indicating comments and action taken for Contractor’s use and distribution.

1. Architect will notify Contractor by email when submittals have been reviewed and posted to PTCS.
2. Architect is not required to return Samples, Project Information and Contract Closeout Information submittals.
3. Submittals may be returned by regular mail at Architect's discretion.

END OF DOCUMENT

SUBMITTAL TRANSMITTAL

PROJECT: Courthouse Renovation Project

SUBMITTAL NO: __ __ __ __ __ __ - __ __ __
SECTION NUMBER ----------| | |
SEQUENCE NUMBER ----------| |
RE-SUBMITTAL CHARACTER ----------|

ARCH PROJ. NO.: 010249/241937

SPECIFICATION TITLE:

MANUFACTURER:

☐ "Base" Manufacturer ☐ "Optional" Manufacturer (Do not submit on manufacturers not listed in specifications)

(Complete attached Optional Manufacturer Product/System Comparison form if manufacturer is an "Optional" manufacturer)

DESCRIPTION OF SUBMITTED ITEM:

NOTE 1: Submittal transmittal to Architect indicates Contractor, and subcontractor have reviewed for compliance with Contract Documents and have approved submittal.

THIS TRANSMITTAL FORM SHALL STAY WITH SUBMITTAL THROUGHOUT ROUTING. COPY FOR FILE.

ROUTING SEQUENCE	ACTION TAKEN BY	DATE REC'D	DATE SENT	NUMBER COPIES	ACTION TAKEN
SUBCONTRACTOR / SUPPLIER:					A NOTE 1
CONTRACTOR:					A NOTE 1
ARCHITECT: HDR Architecture. Inc.					
CONTRACTOR:					
SUBCONTRACTOR / SUPPLIER:			N.A.		
OWNER:	N.A.		N.A.		N.A.

ACTION LEGEND: (Indicate in ACTION TAKEN column above)

A APPROVED
B APPROVED AS NOTED
C REVISE AND RESUBMIT
D NOT APPROVED
E NO ACTION REQUIRED BY ARCHITECT
E1 Submittal not required
E2 Project Information or Contract Closeout Information Submittal

Architect's action taken in accordance with provisions of Contract Documents.

COMMENTS:

❑ SEE ATTACHED COMMENTS ❑ SEE ENCLOSED SUBMITTAL FOR COMMENTS
❑ SUPPLEMENTAL INFORMATION REQUIRED

END OF SUBMITTAL TRANSMITTAL

OPTIONAL MANUFACTURER PRODUCT / SYSTEM COMPARISON

IF SUBMITTING ON A MANUFACTURER LISTED AS "OPTIONAL" IN TECHNICAL SPECIFICATIONS, COMPLETE THIS FORM, AND SUBMIT WITH FIRST SUBMITTAL TRANSMITTAL FOR PRODUCT
(Note: Form not required if "Optional" manufacturer product name, product number or model number or both are specifically listed in technical specification sections)

PROJECT: _____

SUBMITTAL NO: __ __ __ __ __ - __ __
SECTION NUMBER ----------| | |
SEQUENCE NUMBER ----------| |
RE-SUBMITTAL CHARACTER ----------|

Specification Section No.: _____
Article(s)/paragraph(s): _____

PRODUCT / SYSTEM COMPARISON:
Provide a one-to-one comparison with ALL specified requirements.

	SPEC DESIGNATION (IF ANY)	BASE MANUFACTURER'S PRODUCT/SYSTEM	SUBMITTED MANUFACTURER'S PRODUCT/SYSTEM
Manufacturer:			
Name, brand:			
Catalog No.:			
Features.:			
etc.:			

EFFECT OF PRODUCT:

Optional affects other parts of Work:	No ☐	Yes ☐	(If yes, explain below)
Optional requires dimensional revision or redesign of structure or mechanical and electrical Work:	No ☐	Yes ☐	(If yes, explain below)
Same warranty provided as specified base product:	No ☐	Yes ☐	(If no, explain below)

Explanation: _____

STATEMENT OF CONFORMANCE OF PRODUCT OR SYSTEM TO CONTRACT REQUIREMENTS:
Supplier, Subcontractor and Contractor in making submittal of Optional manufacturer's product or system, or in using an Optional manufacturer's product or system represent:

- ☐ Will coordinate installation of proposed product or system into Work, to include necessary changes or modifications or both to the Work, including additional costs to other contractors, when such changes result solely from the use of an Optional Manufacturer.
- ☐ Waive all claims for additional costs or time extensions related to proposed product or system that subsequently become apparent or are caused by product.
- ☐ Will modify other parts of Work as may be needed by use of proposed product or system to make all parts of Work complete and functioning.

ACKNOWLEDGEMENTS:
FOLLOWING FIRM HEREBY REQUESTS CONSIDERATION OF OPTIONAL PRODUCT OR SYSTEMS:

Requested by (firm): _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone _____

Subcontractor: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone _____

Contractor: _____
Acknowledged by (print & sign): _____ Date: _____
Position: _____ Phone _____

END OF OPTIONAL PRODUCT / SYSTEM COMPARISON

SECTION 01 41 00
CODES, REGULATIONS, AND GUIDELINES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Project design based on, but not limited to, following codes, regulations, and guidelines.
   1. Including:
      a. Nationally published amendments.
      b. Local Amendments.
   2. Additional requirements may be indicated in specification sections.

B. Contractor is not required to ascertain Contract Documents are in accordance with applicable laws, statutes, ordinances, building codes, and rules and regulations, unless they bear upon construction means, methods, techniques or safety and health precautions, however nonconformity discovered by or made known to Contractor shall be reported promptly to Architect.

1.2 INDEX

A. Building Code:
   1. International Building Code (IBC).
      a. Edition: 2006

B. Life Safety Code:
   1. NFPA Life Safety Code 101.
      a. Edition: 2000.

C. Fire Code:
   1. ICC International Fire Code (IFC).
      a. Edition: 2003.

D. Accessibility:
   1. ADA Accessibility Guidelines.
      a. 2010 with Municipal and/or State code amendments.
   2. International Code Council.
      a. ICC A117.1.
      b. Edition: 2003.
   3. Where multiple codes are listed, and requirements differ, comply with the most stringent language.

E. Mechanical Code:
   1. International Mechanical Code.
      a. Edition: 2003.
   2. See Section 20 05 00.

F. Plumbing Code:
   1. International Plumbing Code.
      a. Chapter 49 Omaha Municipal Code and 2010 Omaha Plumbing Code
   2. See Section 20 05 00.

G. Electrical Code:
   1. NFPA 70: National Electrical Code.
      a. Edition: 2014.
   2. See Section 26 00 10.

H. Energy Code:
   1. International Energy Conservation Code.
      a. Edition: 2009.
   2. See Section 26 00 10.

I. Occupational Safety and Health Standards:
   1. OSHA Regulations (Standard 29 CFR) - Part 1910.

J. Tornado and Hurricane Safe Room Guidelines:
   1. Federal Emergency Management Agency (FEMA):
      a. Design and Construction Guidance for Community Safe Rooms FEMA P-361, Second Edition / August 2008.
   2. International Code Council (ICC):
      a. ICC 500: 2008 Standard for the Design and Construction of Storm Shelters.

K. Special Seismic Certification:
   1. Comply with International Building Code (IBC), Section 1708 and ASCE 7, Section 13.2.2.
   2. Document certification of required components in one of three ways:
      a. Shake Table Testing:
         1) Testing shall be based upon nationally recognized standards and procedures, such as ICC-ES AC 156, or as acceptable to Authority Having Jurisdiction.
         2) Test reports shall satisfy design requirements of component specified with capacities exceeding site required seismic demand forces provide with following parameters used:
            a) SDS
            b) Wp
            c) Ip
            d) ap
            e) Rp
            f) z/h ratio
      b. Experience Data:
         1) Base data upon nationally recognized standards and procedures, or as acceptable to Authority Having Jurisdiction.
         2) Experience shall satisfy design requirements of component specified with capacities exceeding the site required seismic demand forces.
      c. Rugged Component Exemption:
         1) Components shall have sufficient evidence demonstrating compliance in being rugged and shall be approved by the agency having jurisdiction.
         2) Items that may be classified as rugged without evidence:
            a) Valves (not in cast-iron housings, except for ductile cast iron)
            b) Pneumatic operators
            c) Hydraulic operators
            d) Motors and motor operators
            e) Horizontal and vertical pumps (including vacuum pumps)
            f) Air compressors
            g) Sterilizers
            h) Blanket warmers
            i) Anesthesia power columns, ceiling, or wall mounted
            j) Refrigerators and freezers
            k) Microwave ovens for patient services
            l) Film illuminators
            m) Elevator cabs
            n) Underground tanks
         3) Components weighting not more than 20 LBS supported directly by structures.

3. Partial list of common components requiring special seismic certification:
   a. Architectural:
      1) CT systems
      2) Nurse call systems
      3) Radiography/fluoroscopy systems
   b. Mechanical:
      1) Air-conditioning units
      2) Air filters
      3) Air-handler units
      4) Chillers
      5) Condensers
      6) Cooling towers
      7) Day tanks
      8) Exhaust/smoke control fans
      9) Fan coils
      10) Fuel tanks
      11) Humidification systems
      12) Radiators
   c. Electrical:
      1) Battery cabinets
      2) Busways
      3) Control panels
      4) Distribution panels
      5) Generators
      6) Motor control centers
      7) Power isolation and correction systems
      8) Substations
      9) Switchboards & switchgears
      10) Transformers
      11) UPS cabinets

L. Reference Standards:
   1. Refer to technical specification sections for listed standards.
   2. Refer to Section 01 42 19 for the applicable edition of each standard indicated.

1.3 SUBMITTALS

A. Project Information:
   1. Provide manufacturer documentation justifying compliance with one of three methods referenced above – Shake Table Testing, Experience data or rugged components.

END OF SECTION

SECTION 01 42 10

ABBREVIATIONS - TERMINOLOGY

A	acid, compressed air
AB	anchor bolt, air barrier, air blender, auger boring
A/C	air condition, air conditioner
AC	air compressor, alternating current, architectural casework, asphaltic concrete
ACB	air circuit breaker
ACH	air changes per hour
ACIP	architectural cast in place concrete
ACLD	air cooled
ACSR	aluminum conduit or steel reinforced
ACU	air conditioning unit
ACV	air control valve
AD	area drain, automatic damper
ADJ	adjust, adjustable
A/E	Architect/Engineer
AF	access flooring, air filter, amps frame
AFD	adjustable frequency drive
AFF	above finished floor
AFG	above finished grade
AFH	air filter housing
AFM	air flow meter
AGGR	aggregate
AHU	air handling unit
AIC	ampere interrupting capacity
ALUM	aluminum
ALT	alternate
AM	amplitude modulation, ammeter, acoustical material
AMB	ambient
ANCT	acid neutralization tank
AMP	amplifier
ANOD	anodized
ANN	annunciator
ANS	automatic answer and recall switch
ANT	antenna
APC	architectural precast concrete
APD	air pressure drop
ARCH	architectural
ARR	arrester
ASPH	asphalt
AT	autotransformer
ATS	automatic transfer switch
ATF	athletic flooring
ATM	atmosphere
ATU	air terminal unit
AUTO	automatic
AUX	auxiliary
AV	acid vent
AW	acid waste
AWC	acrylic wall coating
B	boiler, bottom
BB	boiler burner, broad band
BBD	boiler blowdown, broad band data
B to B	back to back
B & B	balled and burlapped
B & BB	breakers and bus bracing
BARO	barometer
BAS	building automation system
BCCMP	bituminous coated corrugated metal pipe
BDD	backdraft damper
BDF	building distribution frame
BF	boiler feed, bamboo flooring
BFP	backflow preventer
BFS	boiler feed system
BHC	booster heating coil
BKR	breaker
BKT	bracket
BL	bed locator, baseline
BLDG	building
BM	beam
BOF	bottom of footing
BP	base plate
BR	bare root, bottom register, bullet resistive
BRG	bearing
BRZ	bronze
BS	barium sink
BSMT	basement
BT	bathtub
BUR	built-up roof
BWS	brine water supply
BWR	brine water return
C	conduit
C & G	curb and gutter
CA	cold air, cardiac arrest
CAC	custom acoustical ceiling
CAD	cadmium
CALL	incoming call
CANT	cantilever
CAP	capacity
CATV	community antenna television
CB	chalkboard, circuit breaker, catch basin
CC	cooling coil
CCT	cubical curtain track
CCTV	closed circuit television
CCW	counter clockwise
CD	ceiling diffuser, condensate drain, coiling door
CFCI	contractor furnished, contractor installed
CFS	concrete floor sealer

CFWC	composite fiber wall covering
CG	container grown, corner guard, coiling grille, center of gravity
CGU	ceramic glazed units
CH	chiller
CHW	chilled drinking water
CI	cast iron
CIP	cast iron pipe, cast in place
CIR	circulating
CJ	construction joint, control joint
CJP	complete joint penetration
CKS	control key switch
CKT	circuit
CL	center line
CLG	ceiling, cooling
CLPR	clean low pressure steam return
CLPS	clean low pressure steam supply
CLR	clear
CM	Construction Manager
CMP	corrugated metal pipe
CMPA	corrugated metal pipe arch
CMPR	compressor, clean medium pressure steam return
CMPS	clean medium pressure steam supply
CMU	concrete masonry unit
CO	cleanout, carbon monoxide
CO2	carbon dioxide
COL	column
CONC	concrete
COND	condition, condenser, condensing, condensation
CONN	connection
CONST	construction
CONT	continuous
CONTR	contractor
CONV	converter
CORR	corridor
CP	concrete pipe (non-reinforced),
CPD	condensate pump discharge
CPR	change proposal request
CPT	carpet
CPTT	carpet tile
CPU	central processor unit
CPVC	chlorinated polyvinyl chloride
CR	control room, ceiling register, crash rail
CRAF	clean room raised access flooring
CRCS	clean room ceiling system
CRF	condensation resistance factor
CRPS	clean room partition system
CRIT	critical
CS	concrete stain, counter shutter
CSI	current source inverters
CSMU	calcium silicate masonry unit
CSS	clinical service sink
CSV	cushioned sheet vinyl
CT	ceramic tile, cooling tower, current transformer, computer terminal
C TO C	center to center
CTR	center, cooling tower return, controlled time run
CTS	cooling tower supply
CU	condensing unit, copper
CUH	cabinet unit heater
CULV	culvert
CW	cold water, clockwise
CWS	chilled water supply, curtain wall system
CWR	chilled water return
D	delta, depth
DB	dry bulb, decibel, direct bury
DBA	deformed bar anchor
DBL	double
DBT	dry bulb temperature
DC	direct current
DD	diversion dike
DDC	direct digital control
DEMO	demolition, demolish
DET	detail
DF	drinking fountain
DIC	difference in conditions contract
DIFF	difference
DIM	dimension
DISP	dispenser
DIP	ductile iron pipe
DIST	distribution, distilled
DIW	deionized water
DIWI	double-inlet, double-width
DL	dead load
DLF	decorative laminate flooring
DLO	daylight opening
DMPR	damper
DN	down
DO	ditto
DP	data processing, differential pressure, dew point
DPA	damper position adjustment
DPAN	distribution panel
DPF	decorative polymer fabrication
DPS	door position switch
DR	drain
DS	downspout
DT	dew point temperature, drain tile
DTS	data transmission system
DW	display wall
DWC	dry erase wall covering
DWG	drawing
DWH	domestic water heater
DWL	dowel
DWV	drain, waste and vent
DX	direct expansion

E SCAN	emergency medical status scan switch
EA	exhaust air, expansion anchor, each
EAH	exhaust hood
EAT	entering air temperature
EE	electrical engineer
EEG	electro encephalograph
EF	exhaust fan
EFF	efficiency
EFT	electric finned tube
EGS	ethylene glycol supply
EGR	ethylene glycol return
EH	electric heater
EIFS	exterior insulation finish system
EJ	expansion joint
EJC	expansion joint cover
EKG	electro cardiograph
EL	elevation
ELEC	electrical
EM	electro-magnetic
EMB	embedment
EMER	emergency
EMI	electro-magnetic interference
EMS	energy management system
EMT	electrical metallic tubing
ENG	engine
ENGR	Engineer
EO	exit only, electrically operated
EPDM	Ethylene Propylene Diene Monomer
EPR	ethylene propylene rubber
EPT	electric power transfer
EQ	equal
EQF	engineered quartz fabrication
EQUIP	equipment
ER	emergency room, exhaust register
ES	emergency shower
EST	estimate
ET	expansion tank
EV	evaporator
EVT	equiviscous temperature
EW	each way
EWC	electric water cooler
EWT	entering water temperature
EXC	excavate
EXH	exhaust
EXP	expansion, exposed
EXIST	existing
EXT	exterior
F	filter
F TO F	face to face
FA	fire alarm, face area
FC	foot control
FCAN	full capacity above nominal
FCBN	full capacity below nominal
FCO	floor clean out
FCS	fire command station
FCU	fan coil unit
FD	fire damper, floor drain
FDN	foundation
FDV	fire department valve
FE	fire extinguisher, finished end
FEC	fire extinguisher cabinet
FF	final filter
FH	fire hose
FHC	fire hose cabinet
FHV	fire hose valve
FIN	finished
FL	floor
FLA	full load amps
FLUOR	fluorescent
FM	frequency modulation radio
FO	fiber optic
FOBB	fiber optic backbone
FOCC	fiber optic cross connect
FODC	fiber optic distribution cabinet
FOF	fuel oil fill
FOR	fuel oil return
FOS	fuel oil supply
FOSE	fiber optic service entrance
FOV	fuel oil vent
FP	full penetration
FR	fire retardant
FRP	fiberglass reinforced plastic
FS	floor sink
FSD	flexible strip door
FSK	foil scrim kraft
FT	finned tube
FTG	footing
FURN	furnish
FU	furnace unit
FUT	future
FV	field verify, face velocity
FVC	fire valve cabinet
FW	flammable waste
FXTR	fixture
G	gas, ground, grille
GA	gauge, gage
GALV	galvanize(d)
GC	high build glazed coating, general contractor
GCWR	glycol chilled water return
GCWS	glycol chilled water supply
GEN	generator
GF	granular fill, granite flooring
GFI	ground fault interrupter
GFP	ground fault protection
GFCI	ground fault circuit interrupter
GFRC	glass fiber reinforced cement
GFRG	glass fiber reinforced gypsum
GI	galvanized iron
GL	glass

GR	grade
GUM	glass unit masonry
GWB	gypsum wallboard
GWS	glycol water supply
GWR	glycol water return
GYP	gypsum
GYWC	glass yarn wall covering
H	humidifier, height
HA	hot air
H2O	water
HB	hose bibb, horizontal blinds
HBC	high build glazed coating
HC	heating coil
HCWS	hot chilled water supply
HCWR	hot chilled water return
HD	heavy duty
HDG	hot dip galvanized
HDPE	high density polyethylene
HDWD	hardwood
HE	helium
HECMP	horizontal elliptical corrugated metal pipe
HG	mercury
HID	high intensity discharge
HK	hook
HM	hollow metal
HORIZ	horizontal
HOSP	hospital grade
HP	heat pump, horse power, high point
HPS	high pressure sodium, high pressure steam supply
HPR	high pressure steam return
HR	handrail, hour
H-STAT	humidistat
HS	headed studs
HSB	high strength bolt
HT	heat
HTG	heating
HTR	heater
HV	high voltage
HVAC	heating, ventilating and air conditioning
HW	hardware group, hot water
HWC	hot water circulating
HWS	hot water supply
HWR	hot water return
HX	heat exchanger
HZ	hertz
IAQ	indoor air quality
IC	intercom
ICW	industrial cold water
ID	inside diameter
IG	isolated ground
IH	intake head
IHW	industrial hot water
IMC	intermediate metal conduit
INCAND	incandescent
INFO	information
INSUL	insulation
INT	interior
INWC	inches water column
I/O	input/output
IPS	iron pipe size
IU	induction unit
IV	intravenous
IVT	intravenous track
IWR	ice water return
IWS	ice water supply
JC	Janitor’s closet
JT	joint
KO	knockout
KT	keyboard tray
KSI	kips per square inch
L	length, lavatory, lock
LA	lightning arrester
LAT	leaving air temperature
LAV	lavatory
LC	lead covered
LAHP	laboratory air (high pressure)
LALP	laboratory air (low pressure)
LCD	liquid crystal display
LCW	laboratory cold water
LD	linear diffuser, laboratory drain
LDW	less door width
LED	light emitting diode
LF	limestone flooring
LHWC	laboratory hot water circulating
LIM	line isolation monitor
LIN	linear, lineal
LL	liveload, lead lined
LLH	long leg horizontal
LLV	long leg vertical
LMC	linear metal ceiling
LN	linoleum, liquid nitrogen
LONG	longitudinal
LP	low point
LPR	low pressure steam return
LPS	low pressure steam supply
LR	linear return
LRA	locked rotor amps
LS	life safety, life support
LSH	long slotted holes
LSS	lock status switch
LT	light
LTGWR	low temperature glycol water return

LTGWS	low temperature glycol water supply
LV	low voltage
LVT	laboratory vent pipe
LVTR	laboratory vent through roof
LW	lightweight, laboratory waste
LWIC	lightweight insulating concrete
LWT	leaving water temperature
M	meter
MA	mixed air, make-up air
MAS	masonry
MATL	material
MATV	master antenna television
MAU	make-up air unit
MAX	maximum
MB	main breaker, markerboard
MBH	thousand BTUH
MCB	main circuit breaker
MCC	motor control center
MCP	motor circuit protector
MD	manual damper, motion detector
MECH	mechanical
MED	medicine, medical
MEK	methyl ethyl ketone
MERC	mercury
MET	metal
MEZZ	mezzanine
MF	marble flooring
MFR	manufacturer
MGA	medical gas alarm
MH	manhole, metal halide
MIN	minimum
MISC	miscellaneous
ML	metal laminate
MLO	main lugs only
MO	masonry opening, motor operated
MOD	modified
MP	medium pressure
MPS	medium pressure steam supply
MPR	medium pressure steam return
MRGWB	mold and moisture resistant gypsum wallboard
MS	mop sink, motion sensor
MSV	manufactured stone veneer
MTL	material
MTP	metal toilet partition
MWP	metal wall panel
N2	nitrogen
NA	not applicable
NAT	natural
NBD	narrow band data
NBDC	narrow band data cabinet
NC	nurse call, normally closed, non-corrosive
ND	normal duty
NDC	nose down curb
NDT	non-destructive testing
NEG	negative
NET	nylon entrance tile
NFWC	natural fiber wall covering
NWT	normal weight
NI	nickel
NIC	not in contract
NP	non-plenum
NPO	non-plenum office
NPS	nominal pipe size
NPT	nominal pipe thread
NO	number, normally open, nitrous oxide
NOM	nominal
NR	noise reduction
NRC	noise reduction coefficient
NST	natural stone tile
NTS	not to scale
O2	oxygen
OA	outside air
OC	on center, overcurrent
OCB	oil circuit breaker
OD	outside diameter, overflow roof drain
OF	overflow
OFCI	owner furnished, contractor installed
OFOI	owner furnished, owner installed
OH	overhead
OPNG	opening
OPP	opposite
OPT	operators terminal
OSD	open site drain
OSL	outstanding leg
P	pump, plenum
P SCAN	Personal attention medical status scan
PA	public address
PB	push button, pull box, power brick
PBX	private board exchange
PC	plug connector, portland cement
PCC	portland cement concrete
PCG	polycarbonate corner guard
PCWR	process cooling water return
PCWS	process cooling water supply
PD	pressure drop, pressure drain pipe
PE	Polyethylene
PERF	perforated
PERM	permanent
PF	prefilter, power factor
PFCC	power factor correction capacitor
PFF	provision for future feeder
PH	phase
pH	measure of acidity/alkalinity
PH/0	phase
PHC	preheat coil

PI	passive infrared
PID	proportional-integral-derivative
PIV	post indicator valve
PL	property line, plate, pilot light, plastic laminate
PLBG	plumbing
PLNJ	paper and lead neoprene jacket
PLS	pure live seed
PNL	Panel
PNT	paint
PNTE	paint (epoxy)
PNTL	paint (latex)
PNTLO	paint (low-odor)
PNSR	paint (stain resistant)
POL	polished
PP	partial penetration, pump plumbing
PPCF	patch panel connection field
PPM	parts per million
PR	pair
PRL	parallel
PROJ	project, projection
PROP	property
PROT	protective, protection
PRV	pressure reducing valve, pressure relief valve
PS	plaster sink, presence sensor, pull switch
PT	printer, pneumatic tube, potential transformers, porcelain tile
PTAC	packaged terminal air conditioner
PTS	pneumatic tube station
PVC	polyvinyl chloride
PVF	polyvinylidene fluoride
PVMT	pavement
PVS	polyvinyl spiral (pipe)
PW	purified water
PWC	purified water circulating
PWD	plywood
PWM	pulse width modulated
QT	quarry tile
QTB	quarry tile base
R	radius, rankine, riser, rubber sheath, register
RA	return air
RAD	radiology
RB	resilient base
RCCP	reinforced concrete culvert pipe
RCF	riser connection field
RCG	recycled glass portland cement countertop
RCP	reinforced concrete pipe, reflected ceiling plan
RCPT	receptacle
RCW	ribbon wall/ curtain wall
RD	roof drain
REC	recess, receiver
RECIRC	recirculate
RED	reducing
REF	reference
REFR	refrigerator
REG	regulator, register
REINF	reinforcement
REL A	relief air
REM	reminder light set and scan switch, removable
RET	retaining, return
REV	revise, revision, reversing, revolutions
RF	return fan, radio frequency
RFI	request for information, radio frequency interference
RFT	rubber floor tile
RGSC	rigid galvanized steel conduit
RH	relative humidity
RHC	reheat coil
RHD	relief hood
RI	rubber insulated
RTI	response time index
RL	refrigerant liquid, roof drain leader
RO	rough opening, reverse osmosis water
RP	radiant panel
RS	refrigerant suction, roller shade
RST	resilient stair tread
RT	resilient tile
RTP	reinforced thermosetting plastic
RTV	room temperature vulcanized
RTZ	urethane rubber terrazzo
RV	reduced voltage, relief vent
RVT	resilient vinyl tile
R/W	right-of-way
RW	return wall register
S	sink, soil (piping), sprinkler (piping), sanitary sewer
SA	shock absorber, supply air, sound attenuator
SAF	surge arrester field
SAN	sanitary
SAT	saturation
SDR	sound distribution rack
SB	sitz bath
SC	sill cock, shading coefficient
SCE	stabilized construction entrance
SCF	station connection field
SCH	schedule
SCR	silicone controlled rectifier
SCSV	static conductive sheet vinyl
SCT	station cable tray, static conductive tile
SCW	soft cold water
SCWR	secondary chilled water return
SCWS	secondary chilled water supply

SD	smoke damper, storm drain, sensing device
SDC	station distribution cabinet
SDOT	star-delta open transition
SDCT	star-delta-closed transition
SDRS	static dissipative resilient sheet flooring
SDRT	static dissipative resilient tile flooring
SEC	security
SECT	section
SEF	seamless epoxy flooring
SERV	service
SEOR	structural engineer of record
SF	supply fan, silt fence, square feet
SFD	smoke actuated fire damper
SFWC	synthetic fiber wall covering
SG	supply grille
SGB	signal grounding bus
SGD	sectional glass door
SGL	single
SH	shower, sensible heat
SHW	soft hot water
SHWC	soft hot water circulating
SIM	similar
SIWI	single-inlet, single-width
SL	sliding
SOG	slab on grade
SP	standpipe, sump pump, static pressure, single pole
SPA	setpoint adjustment, spaces
SPD	standpipe drain
SPDT	single pole double throw
SPEC	specification
SPKR	sprinkler, speaker
SPS	security pushbutton switch
SQ	square
SR	sheet rubber, supply register
SRV	safety relief valve
SS	service sink, sanitary sewer, stainless steel, storm sewer
SSCG	stainless steel corner guard
SSD	sectional steel door
SSF	solid surface fabrication
SSH	short slotted holes
SSS	surgeons' scrub sink, solid state starter
SST	stainless steel sink
ST	steam trap
STA	station, stationary
START	starter
STC	sound transmission class
STD	standard
STDWT	standard weight
STIFF	stiffener
STIR	stirrup
STM	steam
STOR	storage
STP	shielded twisted pair
STR	strainer
STRUCT	structural
SUF	seamless urethane flooring
SUSP	suspend(ed)
SV	sheet vinyl, steam vent
SVD	switched voice and data
SW	supply wall grille, switch, soft water, sidewalk
SWBD	switchboard
SWD	sectional wood door
SWC	soft wall covering
SWGR	switchgear
SX	steam exhaust
SYM	symmetrical
SYS	system
T	toilet, tank, temperature
T & B	testing and balancing, top and bottom
T & G	tongue and groove
TA	tempered air, transfer air, toilet accessories
TB	tackboard
TBB	tile backer board
TD	temperature differential
TDC	transverse duct connection
TEFC	totally enclosed fan-cooled
TEL	telephone
TEMP	temperature, temporary
TENV	totally enclosed non-ventilated
TERR	terrazzo
TERM	terminal
TFC	textured finish coating
TH	total heat, total head (pumps)
THD	Total Harmonic Distortion
TOC	top of curb, top of concrete
TOF	top of footing
TONE	tone transfer
TOS	top of steel
TOW	top of wall
TP	total pressure, twisted pair
TPC	textured plastic coating
TPO	thermoplastic olefin
TPWC	thermoplastic olefin wallcovering
TR	top of register
T-STAT	thermostat
TSP	total static pressure
TSU	thermal storage unit
TU	terminal unit
TV	television
TVSS	transient voltage surge suppressor
TX	transformer
TYP	typical
UC	undercounter
UD	underdrain

UG	underground
UGE	underground electric
UGS	underground signal
UGT	underground telephone
UH	unit heater
UHF	ultra high frequency
UNEX	unexcavated
UNO	unless noted otherwise
UPS	uninterruptible power supply
UPWC	ultra pure water circulating
UPWR	ultra pure water return
UPWS	ultra pure water supply
UR	urinal
US	utility sink, ultrasound
UTIL	utility
UV	ultraviolet
V	valve, vent, velocity, vacuum
VAC	vacuum, volts alternating current
VAV	variable air volume
VB	vapor barrier, vacuum breaker
VCG	vinyl corner guard
VCP	vitrified clay pipe
VCPX	vitrified clay pipe, extra strength
VD	volume damper
VERT	vertical
VEST	vestibule
VF	ventilation fan
VFD	variable frequency drive
VHF	very high frequency
VM	voltmeter
VOC	volatile organic compound
VOL	volume
VP	vacuum pump, velocity pressure, venetian plaster
VR	vapor retarder
VRI	variable volume with reheat interior
VS	venturi station, vacuum (canister) slide
VSI	voltage source inverters
VT	vinyl tile
VTR	vent through roof
VV	variable volume
VVR	variable volume with reheat
VWC	vinyl wall covering
W	width, waste (piping), water, wire
W/	with
WB	wet bulb
WBT	wet bulb temperature
WC	water closet
WD	wood
WDW	window
WF	wall fin, wood flooring
WG	water gauge, wall guard
WH	water heater, wall hydrant
WHA	water hammer arrester
WL	wind load
WLD	welded
WM	wattmeter
W/O	without
WP	waterproofing, weatherproof, work point
WPD	water pressure drop
WPF	waterproof flooring
WS	wall switch, waterstop, water softener, waste stack
WT	weight
WWR	welded wire reinforcement
XFMR	transformer
XL	extra long
XLPE	cross linked polyethylene
XP	explosion proof
X-STR	extra strength
YD	yard
YH	yard hydrant
YR	year
Y,W	wye
ZA	zone annunciator
ZN	zone
1P	one pole
2P	double pole
1S	single speed
2S	two speed
1W	one winding
2W	two winding

END OF SECTION

SECTION 01 43 43
COORDINATION DRAWINGS (GC)

PART 1 - GENERAL

1.1 DESCRIPTION - INTERIOR

A. Coordinate construction operations included in various Sections of Specifications to assure efficient and orderly installation of all parts of Work. Coordinate construction operations included under different Sections that depend on each other for proper installation, connection, and operation.

B. Coordination drawings: Reproducible overlay drawings showing work with horizontal and vertical dimensions to avoid interference with structural framing, ceilings, partitions, equipment, lights, mechanical, electrical, conveying systems, and other services:
   1. In and above ceilings.
   2. Within walls.
   3. Within chases and shafts.
   4. Under concrete floors on grade.
   5. In mechanical spaces.
   6. In electrical spaces.
   7. Below grade.

C. Prepare coordination drawings where careful coordination is needed for installation of products and materials fabricated by separate entities.

D. Prepare coordination drawings where limited space availability necessitates maximum utilization of space for efficient installation of different components.

E. Coordinate installation of different components to assure maximum accessibility for required maintenance, service, and repair.

F. Work out all “tight” conditions involving Work of various Sections in advance of installation.

G. Sleeve, coredrill and blockout layout drawings:
   1. Drawings showing proposed locations and sizes of sleeves, coredrills blockouts, and embedded items in concrete walls, columns, floors and beams.

H. Prior to start of work in any given area, each Subcontractor approve, in writing, coordination drawings affecting Subcontractor’s work in that area.

I. Modifications required as result of failure to resolve interferences, provide correct coordination drawings, or call attention to changes required in other work as result of modifications shall be paid for by responsible Subcontractor.

J. Coordination meetings scheduled by Contractor, with all affected Subcontractors.

1.2 PRODUCTION OF COORDINATION DRAWINGS

A. Contractor provide minimum 1/4 IN scale plan, elevation and section drawings, showing:
   1. Partitions.
      a. Fire/smoke rated barriers.
   2. Ceiling heights.
   3. Structural framing locations and elevations.
   4. Column lines.
   5. Support systems.
   6. Other work.

B. Subcontractors produce combined coordination layout drawings plan and sections of HVAC ductwork, hydronic, steam, condensate, fuel oil, fire protection piping, plumbing, special water systems, natural gas and medical gas systems electrical cable tray, conduit, conveying systems, equipment, and other work.

C. Resolve major interferences at initial coordination meeting prior to production of any drawings.

D. Produce initial coordination drawings within 30 days after initial meeting.

E. Contractor arrange for production of said drawings not provided by that time.

F. Meet as required to resolve interferences and correct drawings.

1.3 AFTER APPROVAL

A. After Subcontractors' written approval of coordination drawings, Contractor determine method used to resolve interferences not previously identified.

B. Contractor give written approval of changes to coordination drawings prior to start of work in affected area.

C. Maintain one copy of current approved Coordination Drawings at project site.

1.4 PRECEDENCE OF SERVICES FOR COORDINATION DRAWINGS

A. In event of conflicts involving location and layout of work; use following priority to resolve disputes:
   1. Structure and partitions have highest priority.
   2. Equipment location and access.
   3. Support systems
   4. Ceiling system and recessed light fixtures.
   5. Gravity drainage lines.
   6. High pressure ductwork and devices.
   7. Large pipe mains, valves and devices.
   8. Low pressure ductwork, diffusers, registers, grilles, HVAC equipment.
   9. Fire protection piping, devices and heads.
   10. Small piping, tubing, electrical conduit, and devices.
      a. Conduits installed in corridors shall be maintained at least 9 IN above finished ceiling. Conduits shall be grouped within a 12 IN width.
      b. The space utilized for conduit shall be selected to allow access to all devices which normally require adjustment, repair, resetting, etc.
   11. Sleeves through rated partitions.
   12. Access panels.

1.5 PRODUCTION OF LAYOUT DRAWINGS

A. Contractor provide scale plan and elevation drawings.

B. Subcontractors indicate proposed location and size of their required sleeves, coredrills, blockouts and embedded items.
   1. At floor slabs and walls to be core drilled or cut, Find and mark all reinforcing in both faces located by means of x-ray, pach-ometer, or prof-ometer.
   2. Submit sketch showing location of rebar and proposed cores for review.

1.6 SUBMITTALS

A. Project information:
   1. Contractor's approved Coordination Drawings.
      a. Letter indicating one copy of approved Coordination Drawings available at project site.
      b. One copy of approved Coordination Drawings to Architect for information, if requested.
   2. Contractor's proposed sleeve, coredrill and blockout layout drawings.
      a. One copy of drawing to Architect for information.

END OF SECTION

SECTION 01 45 00
QUALITY ASSURANCE AND CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Provisions followed by an asterisk (*) include some or all provision as obtained from AIA Document A201- General Conditions of the Contract for Construction.

1.2 SECTION INCLUDES

A. Quality assurance and control.

B. Regulatory requirements.

C. Tolerances.

D. Mock-ups.

E. Manufacturer's field services.

1.3 QUALITY ASSURANCE AND CONTROL

A. Monitor quality assurance and control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.

B. Comply with manufacturers' instructions, including each step in sequence.

C. Should manufacturer's instructions conflict with Contract Documents, request clarification from Architect before proceeding.

D. Comply with specified standards as a minimum quality for Work except when more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.

E. Have Work performed by persons qualified and experienced to produce required or specified quality.

F. Verify that field measurements are as indicated on approved shop drawings or as instructed by manufacturer of product.

G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion or disfigurement.

H. Materials shall be compatible with one another and with other materials with which they may come in contact.

1.4 SUPERVISION AND CONSTRUCTION PROCEDURES

A. Contractor shall supervise and direct Work, using Contractor’s best skill and attention. *

B. Contractor shall be solely responsible for, and have control over, construction means, methods, techniques, sequences and procedures and for coordinating all portions of Work under the Contract, unless Contract Documents give other specific instructions concerning these matters. *

C. Whether or not Contract Documents give specific instructions concerning construction means, methods, techniques, sequences or procedures, the Contractor shall review, substantiate, and comply with current industry execution standards and manufacturer's current execution instructions and evaluate jobsite safety thereof and shall be fully and solely responsible for jobsite safety of such means, methods, techniques, sequences or procedures. *

1. If Contractor determines that such means, methods, techniques, sequences or procedures may not be safe, the Contractor shall give timely written notice to Owner and Architect and shall not proceed with that portion of Work without further written instructions from Architect. *
2. If Contractor is then instructed to proceed with the required means, methods, techniques, sequences or procedures without acceptance of changes proposed by Contractor, the Owner shall be solely responsible for any loss or damage arising solely from those Owner-required means, methods, techniques, sequences or procedures. *

D. Contractor shall be responsible to Owner for acts and omissions of Contractor's employees, Subcontractors and their agents and employees, and other persons or entities performing portions of Work for, or on behalf of Contractor or any of its Subcontractors. *

E. Contractor shall be responsible for inspection of portions of Work already performed to determine that such portions are in proper condition to receive subsequent Work. *

F. Contractor is solely responsible for coordination of scope of Work for its own forces, and of Subcontractors and suppliers, and to complete all Work, whether performed by the Contractor or a Subcontractor.

G. Contractor shall employ Licensed Surveyor to locate and stake out Work and establish necessary reference and benchmarks.
1. Work from established benchmarks and reference points, layout and correctly establish all lines, levels, grades, and locations of all parts of their own Work and be responsible for their accuracy and proper correlation with Work and established data.

1.5 REGULATORY REQUIREMENTS

A. Contractor shall comply with and give notices required by applicable laws, statutes, ordinances, codes, rules and regulations, and lawful orders of public authorities applicable to performance of Work. *

B. If Contractor performs Work knowing it to be contrary to applicable laws, statutes, ordinances, codes, rules and regulations, or lawful orders of public authorities, the Contractor shall assume appropriate responsibility for such Work and shall bear the costs attributable to correction, including, but not limited to, any penalties, fines or other damages realized. *

C. When Contract Documents require Contractor, Subcontractor, Vendor or other supplier to provide selection or design of parts of Work, such selection or design shall meet requirements of Municipal, State or other governmental authorities having jurisdiction.

1.6 TOLERANCES

A. Monitor fabrication and installation tolerance control of Products to produce approved Work. Do not permit tolerances to accumulate.

B. Comply with manufacturers' tolerances. Should manufacturers' tolerances conflict with Contract Documents, request clarification from Architect before proceeding.

C. Adjust Products to appropriate dimensions; position before securing Products in place.

1.7 MANUFACTURER'S FIELD SERVICES AND REPORTS

A. When field services are specified, have material or product suppliers, or manufacturers, provide technically competent staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment and supervise installation where specified, as applicable and to initiate instructions when necessary.

B. Report observations, and site decisions or instructions given to applicators or installers which are supplemental or contrary to manufacturer's written instructions.

C. Submit report in duplicate within 30 days of observation.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify existing site conditions and substrate surfaces are acceptable for subsequent work. Beginning new work means acceptance of existing conditions.

B. Verify existing substrate is capable of structural support or attachment of new work being applied or attached.

C. Examine and verify specific conditions described in individual Specification Sections.

D. Verify that utility services are available, of correct characteristics, and in correct locations.

3.2 PREPARATION

A. Clean substrate surfaces prior to applying next material or substance.

B. Seal cracks or openings of substrate prior to applying next material or substance.

C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

END OF SECTION

SECTION 01 45 23
TESTS AND INSPECTIONS

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. General:
1. Work shall be subject to inspection, testing and approval by testing agency, inspector and building official, or public authorities having jurisdiction.
2. Approval as result of inspection or testing shall not be construed to be an approval of a violation of provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
3. Testing, inspections and approvals presuming to give authority to violate or cancel provisions of Contract Documents, or by governing codes, laws, ordinances, rules or regulations shall not be valid.
4. It shall be duty of Contractor to cause Work to remain accessible and exposed for testing and inspection purposes.
5. It shall be duty of Contractor to notify testing agency, inspector and building official or public authorities having jurisdiction when Work is in conformance with Contract Documents and is ready for testing and inspection.
6. It shall be duty of Owner and Contractor to provide access to, and means for testing and inspections of such Work required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations.
7. Any portion that does not comply shall be corrected and shall not be covered or concealed until authorized by testing agency, inspector and public authorities having jurisdiction.
8. Tests, inspections and approvals of portions of Work required by Contract Documents or by codes, laws, ordinances, rules, regulations or orders of building official or public authorities having jurisdiction shall be made at an appropriate time.
9. Contractor shall give testing agency, inspector, building official or public authorities having jurisdiction, and Architect, if requested, timely notice of when and where tests and inspections are to be made so that they may be present for such procedures.
10. In event such procedures for testing, inspection and approval reveal portions of Work fail to comply with requirements established by Contract Documents, or by governing codes, laws, ordinances, rules or regulations, all costs made necessary by such failure, including those of repeated procedures and compensation for Architect's services and expenses, shall be at Contractor's expense.
11. Required certificates of testing, inspection and approval shall, unless otherwise required by Contract Documents, be secured by Contractor and promptly delivered to Architect, inspector, building official and public authorities having jurisdiction.
12. If Architect, Owner, building official, public authorities having jurisdiction, testing agency or inspector is to observe tests, inspections and approvals required by Contract Documents, or by governing codes, laws, ordinances, rules or regulations or orders of building official or public authorities having jurisdiction, they will do so promptly, and where practicable, at normal place of testing.
13. Construction or Work for which a building permit is required shall be subject to inspections by building officials and such construction or Work shall remain accessible and exposed for inspection purposes until approved.
    a. Building officials is authorized to accept reports of approved inspection agencies, provided such agencies satisfy requirements as to qualifications and reliability.
    b. See governing codes, laws, ordinances, rules and regulations for additional requirements.

B. Test and inspection method standards: See technical sections and governing codes, laws, ordinances, rules and regulations.

C. Qualifications of independent testing agencies:
   1. Testing agency shall comply with governing codes, laws, ordinances, rules and regulations.
      a. Testing agency shall provide all information necessary for building official to determine that testing agency meets applicable requirements.
      b. Testing agency shall be objective, competent and independent from Contractor responsibility for Work being inspected.
      c. Agency shall disclose possible conflicts of interest so that objectivity can be confirmed.
      d. Agency shall have adequate equipment to perform required tests, and equipment shall be periodically calibrated.
      e. Agency shall employ experienced personnel educated in conducting, supervising and evaluating tests and/or inspections.
      f. See governing codes, laws, ordinances, rules and regulations for additional requirements.
   2. Meet American Council of Independent Laboratories, Recommended Requirements of Independent Laboratory Qualification, latest edition.
   3. Meet requirements of ASTM E329, Standards of Recommended Practice for Inspection and Testing Agencies for Concrete, Steel and Bituminous Materials as used in Construction, latest edition.
   4. Meet requirements of AASHTO Materials Reference Library (AMRL) R18 Standard Practice for Establishing and Implementing a Quality Management System for Construction Materials Testing Laboratories.
   5. Meet requirements of ISO/IEC 17025 General Requirements for the Competence of Testing and Calibration Laboratories.
   6. Satisfy inspection criteria of Materials Reference Laboratory of National Bureau of Standards.
   7. See technical sections for additional requirements.

D. Testing equipment calibration: Shall be by accredited calibration agency, at maximum 12 month intervals, by devices of accuracy traceable to either:
   1. National Institute of Standards and Technology.

E. Special Inspections:
   1. Owner will employ one or more special inspectors to perform inspections during construction on types of Work required by governing codes.
      a. These inspections are in addition to inspections by building officials having jurisdiction.
      b. See governing codes, laws, ordinances, rules and regulations for additional requirements.

1.2 DESCRIPTION

A. Contractor will arrange and pay for following testing and inspections performed by testing agency or special inspector:
   1. Concrete testing and evaluation of installed work: Section 03 08 13.
   2. Concrete reinforcing testing and inspection: Section 03 20 00.
   3. Concrete floor finish tolerance testing: Section 03 35 00.
   4. Portland cement-lime mortars and grout testing: Section 04 05 13.
   5. Masonry accessory installation inspection: Section 04 05 23.
   6. Dovetail slots installation inspection: Section 04 05 21.
   7. Concrete masonry inspection: Section 04 22 00.
   8. Structural steel welding, bolts and stud testing and inspection, except testing to qualify welders: Section 05 12 10.
   9. Composite metal form deck inspection: Section 05 36 00.
   10. Concrete Floor Moisture Testing: Section 07 16 04.
   11. Fireproofing testing and inspection: Section 07 81 16.

12. Testing and balancing mechanical systems: Section 20 08 00.

B. Contractor arrange and bear all related costs for following tests, inspections and approvals with an independent testing agency or entity acceptable to Owner:
   1. Concrete testing for qualification of proposed materials, establishment of mix design, and for Contractor's convenience: Section 03 08 13.
   2. Portland cement-lime mortars and grout testing for qualification of materials and for Contractor's convenience: Section 04 05 13.
   3. Structural steel welding testing to qualify welders: Section 05 12 10.
   4. Rebar locating for drilling, core drilling or cutting of concrete.
   5. Testing of manufacturers' products for compliance with specifications.
   6. All other testing and inspections specified.
   7. Testing and inspections of Contractor provided shoring or forming.
   8. Any additional inspection and testing required by public authorities having jurisdiction.
   9. Contractor's duties for Owner provided tests, as specified.

C. Contractor shall arrange for, and bear all related costs for following with Owner provided independent testing agency, or entity acceptable to Owner:
   1. Re-testing due to failure of initial test or due to nonconformance with Contract Documents.
   2. Re-inspections of Work due to failure of Work to pass initial inspection or due to nonconformance with Contract Documents.

1.3 JOB CONDITIONS

A. Employment of independent testing agency does not relieve obligation of Contractor to comply with Contract Documents.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PERFORMANCE

A. Perform indicated inspections, sampling and testing of materials and methods of construction.

B. Use test and inspection or sampling methods or both conforming with methods indicated.

C. Report each test and inspection or sampling or both as indicated.

D. Report results called for by test method, in form specified.

E. Retest failed products and systems.

3.2 REPORTS

A. Submit reports and logs promptly to Architect, Structural Engineer, Contractor, inspector, and public authorities having jurisdiction.

B. Include following for test or inspection reports or both:
   1. Project name and number.
   2. Project location.
   3. Product and specification section applicable.
   4. Type of test or inspection or both.
   5. Name of testing agency, if used.
   6. Name of testing or inspecting personnel, or both.
   7. Date of test or inspection or both.
   8. Record of field conditions encountered; i.e., temperature, weather.
   9. Test location.
   10. Observations regarding compliance.

11. Test method used.
12. Results of test.
13. Date of report.
14. Signature of testing or inspecting personnel or both.

C. Maintain log of tests which have failed:
1. Type of test or inspection or both.
2. Date of test or inspection or both.
3. Test or inspection number or both.
4. Reason failed.
5. Date of retest or inspection or both.
6. Results of retest.
7. Method of retest.

3.3 INDEPENDENT TESTING AGENCY DUTIES AND LIMITATIONS OF AUTHORITY

A. Cooperate with Architect and Contractor.

B. Provide qualified personnel promptly on notice.

C. Promptly notify Architect and Contractor of irregularities, or deficiencies of work which are observed during performance of services.

D. Testing agency is not authorized to:
1. Release, revoke, alter, or enlarge on requirements of Contract Documents.
2. Approve or accept any portion of Work.
3. Perform any duties of Contractor.

3.4 CONTRACTOR'S DUTIES

A. Cooperate with testing agency personnel, inspector and public authorities having jurisdiction and provide access to work.

B. Provide preliminary representative samples of materials to be tested, in required quantities.

C. Furnish copies of mill test reports.

D. Furnish labor and facilities:
1. To provide access to work to be tested.
2. To obtain and handle samples at site.
3. To facilitate inspections and tests.
4. Storage and curing facilities for testing agency's exclusive use.

E. It is duty of Contractor to notify building official and testing agencies when Work is ready for inspections.

F. Construction or Work for which Special Inspections are required shall remain accessible and exposed for special inspections purposes until completion of required special inspections.

G. It is duty of Contractor to provided access to and means for inspections by building officials and testing agencies of such Work that are required.

H. Work shall not be done beyond point indicated in each successive inspection without first obtaining approval of building official.

I. Any portion of Work that does not comply shall be corrected and such portions shall not be covered or concealed until authorized by building official.

J. Notify appropriate testing agency, inspector or public authorities having jurisdiction sufficiently in advance of operations.

END OF SECTION

SECTION 01 50 00

CONSTRUCTION FACILITIES, TEMPORARY CONTROLS AND UTILITIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Construction Facilities, Temporary Controls and Utilities, as indicated, in accordance with provisions of Contract Documents.

B. Coordinate all temporary security desks and entrances with owner.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Comply with industry standards and applicable laws and regulations of authorities having jurisdiction including, but not limited to following:
   1. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations.
   2. International Building Code – Chapter 33 – Safeguards During Construction.
   3. Building code requirements.
   4. Health and safety regulations.
   5. Utility company regulations.
   6. Police, fire department, and rescue squad rules.
   7. Environmental protection regulations.
   8. Local agencies requirements and regulations.

B. Maintain required exits, existing structural elements, fire protection devices and sanitary safeguards during remodeling, alterations, repairs or additions to any building or structure, except; make adequate substitute provisions when such required elements or devices are being remodeled, altered or repaired, , or when existing building is not occupied.

C. Arrange for authorities having jurisdiction to inspect and test each temporary utility before use. Obtain required certifications and permits for temporary utilities, and shall include in base bid fees, labor and materials for necessary services.

D. Use qualified personnel for installation of temporary facilities. Locate facilities where they will serve Project adequately and result in minimum interference with performance of Work. Relocate and modify facilities as required.

1.3 TEMPORARY UTILITIES - GENERAL

A. Fees, labor, and materials, including temporary equipment and connection thereof, required to provide temporary utility services necessary for maintaining existing services and for execution of Work, and tests required in various sections of Specifications shall be provided by Contractor at Contractor's expense, except where otherwise specified.

B. Maintain and keep temporary services and facilities clean and neat in appearance, including those furnished or provided by Owner for Contractor's use.

C. Operate in a safe and efficient manner. Coordinate with Owner to relocate temporary services and facilities as Work progresses.

D. Do not overload facilities or permit them to interfere with progress.

E. Take necessary fire-prevention measures.

F. Do not allow hazardous, dangerous, or unsanitary conditions, or public nuisances to develop or persist on-site.

G. Prepare a schedule indicating dates for implementation, shut downs, tie-ins and termination of each temporary utility and coordinate with Owner.

H. At earliest feasible time, when acceptable to Owner, change over from use of temporary service to use of permanent service.

I. Remove all temporary equipment and connections, and leave premises and existing permanent apparatus in an equivalent condition as existed prior to making temporary connections.
   1. Service utility connections shall be discontinued and capped in accordance with the approved rules and the requirements of the authority having jurisdiction.
   2. At completion of Work, remove and replace all damaged parts of permanent systems.

J. Extend warranty or guarantee period on permanent systems used during construction period so they commence on date of Substantial Completion.

1.4 WEATHER PROTECTION

A. Prior to enclosure of building, provide temporary heating, ventilation, and cooling as required to perform Work activities.

B. Provide temporary insulated weathertight closure of exterior openings to accommodate acceptable working conditions and protection for products, to allow for temporary heating and maintenance of required ambient temperatures identified in individual Sections and to prevent entry of unauthorized persons. Provide access doors with self-closing hardware and locks.

1.5 TEMPORARY HEATING, VENTILATION, AND COOLING

A. Maintain temperature of spaces where concrete is being placed or cured: See Section 03 31 10.

B. Provide temporary heating, ventilation, and cooling equipment; and provide temporary heating ventilation, and cooling as required to perform Work.
   1. Substantially complete exterior envelope prior to start of energy systems.
   2. Make all temporary electrical connections and disconnect temporary connections at completion of temporary heating, ventilation and cooling period.
   3. Operate system, furnishing necessary labor and supervision.
   4. Maintain interior temperature and humidity at service temperature and service humidity for at least 48 hours prior to, concrete slab moisture emission and relative humidity testing, and continue through placement of interior finishes, and until Substantial Completion. See Section 07 16 04.
      a. Provide temperature and humidity range required by interior-finish manufacturer's instructions.

C. Select safe equipment that will not have a harmful effect on completed installations, elements being installed or occupants.

D. Coordinate requirements to produce condition required and minimize consumption of energy.

E. Provide adequate forced ventilation of enclosed areas for welding, painting, curing of installed materials and fume producing equipment, to disperse humidity, and to prevent hazardous accumulations of dust, fumes, vapors, or gases.

F. Comply with construction ventilation and preconditioning requirements:
   1. See Section 01 81 21.

G. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is acceptable for operation, equipment is lubricated and filters are in place.

H. Provide and pay for operation, maintenance and regular replacement of filters, and worn or consumed parts.

I. Use devices complying with codes and ordinances.

1.6 TEMPORARY ELECTRICITY AND LIGHTING

A. Make arrangements for and provide equipment, poles, wiring, switches, outlets, etc., to provide 480V, 3 phase power and necessary step down transformers for 208V and 120V power for all lighting and power requirements for construction purposes.
   1. Permanent building power distribution system may be used once it is installed.
   2. Remove all temporary electrical equipment, when no longer needed.

B. Provide adequate lighting with local switching for safe access and egress, security, and for providing adequate illumination for construction operations.
   1. Turn off lighting in areas at end of work day to conserve energy.
   2. If permanent light fixtures are used during construction they shall be re-lamped with new lamps at Substantial Completion.

C. Temporary electrical power used will be paid for by Owner.
   1. Contractor provide any additional electrical power required for Contractor's operation, exceeding available power.
   2. Contractor provide electricity required for electrical welding devices and temporary heating devices.

D. Each installer: Provide own extension cords and electrical safety devices.

E. Each installer: Provide any additional electrical power required for installer's operation, exceeding available power.

1.7 TEMPORARY WATER

A. Owner pay for all water used.
   1. Maintain connections, pipe, fittings and fixtures, and conserve water so none is wasted. Failure to stop leakage or other waste will be cause for revocation (at Owner's discretion) of use of water from Owner's system.

B. Furnish drinking water and paper cups for all those connected with the Work.

1.8 TEMPORARY SANITARY FACILITIES

A. Provide temporary sanitary facilities for use of construction workers during construction, v

B. Do not use existing toilet facilities in occupied areas or new toilet facilities in construction area without Owner's written consent.

C. Provide facilities complying with local, State and Federal sanitary laws and regulations.

D. Maintain and service in clean and sanitary condition.

E. Provide adequate supplies of toilet paper, cleaning and other required items.

1.9 CONTRACTOR'S FIELD OFFICE

A. Owner will provide field office for Contractor's use.

B. Owner will provide Telephone Number:
   1. Telephone: Provide telephones, answering machine telephone service in field office. A telephone shall be available for Owner's and Architect's use.

C. Contractor will provide Fax Machine and Copier:
   1. Provide broadband service with internet connection and dedicated data line T1 minimum, for use by Owner and Architect.
   2. Provide commercial grade photocopy machine with document scanning capability.
   3. Contractor pay service and use charges.

1.10 TEMPORARY ENCLOSURES/PARTITIONS

A. Contractor provide following:

B. Construction Manager provide following:
   1. Provide temporary enclosures, doors, etc. as required to protect building from damage due to vandalism, or the elements, to maintain suitable temperature during installation of finishes, and for security.
   2. Maintain Owner's access to occupied facilities.
   3. Provide temporary fire rated smoke and dust tight partitions between occupied existing areas of building and construction area. Provide rated door where needed for safe egress and access.
   4. Maintain fire exits as required by local fire agency. Provide temporary doors, ramps, stairs, lighting and signage as may be required.
   5. For work on existing fire rated partitions, temporary partitions and doors shall be of equivalent fire rated construction.
   6. Horizontal exit shall not be destroyed unless and until a substitute means of egress has been provided and approved.

1.11 TEMPORARY PEDESTRIAN PROTECTION.

A. Pedestrians shall be protected from injury due to construction activities by temporary barriers or covered walkways or both, or by construction railings in accordance with following guidelines:
   1. Provide temporary barrier and covered walkway when distance from construction activities is not more than one-fourth height of construction.
   2. Provide temporary barrier protection when distance from construction activities is between one-fourth and one-half height of construction.
   3. Provide temporary construction railings when distance from construction activities exceeds one-half height of construction.

B. Provide signage to direct pedestrian traffic.

C. Provide walkway for pedestrian travel in front of every construction site, except when authority having jurisdiction requires sidewalk to be fenced or closed.
   1. Provide walkways with sufficient width to accommodate pedestrian traffic; however, in no case shall walkways be less than 4 FT in width.
   2. Provide walkways with well-drained, durable walking surface.
   3. Walkways shall be accessible in accordance with governing Accessibility Code.
   4. Design walkways to support all imposed loads; however, design live load shall be no less than 150 PSF.
   5. Provide construction railings minimum 42 IN in height.
      a. Railings direct pedestrians around construction areas.

D. Barriers shall be minimum of 8 FT in height and shall be installed on side of walkway nearest construction.
   1. Barriers shall extend the entire length or width of construction site.
   2. Protect pedestrian openings in barriers with doors or gates which shall be accessible only by Owner, Contractor and authorized visitors.
   3. Design barriers to resist loads required in accordance with International Building Code - Chapter 33.

E. Covered Walkway: Erect structurally sound covered walkway with minimum clear height of 8 FT measured from floor surface to canopy overhead.
   1. Extend covered walkway entire length or width of construction site for safe, protected passage of individual persons along adjacent public streets.
   2. Provide as minimum protective plywood sheathed enclosure walls.
   3. Provide adequate lighting and warning signs.

4. Covered walkways shall be designed to support all imposed loads in accordance with International Building Code – Chapter 33 and requirements and regulations of authorities having jurisdiction.

F. Pedestrian traffic shall be protected by directional barricades where walkway extends into street or drives.
   1. Directional barricade shall be of sufficient size and construction to direct vehicular traffic away from the pedestrian path.

G. Pedestrian protection shall be maintained in place and kept in good order for entire length of time pedestrians may be endangered.
   1. Upon completion of construction activity, immediately remove walkways, debris and other obstructions and leave such property in as good a condition as it was before such work was commenced.

H. Every excavation on a site located 5 FT or less from street lot line shall be enclosed with a barrier not less than 6 FT high. Where located more than 5 FT from the street lot line, a barrier shall be erected when required by the building official. Barriers shall be of adequate strength to resist wind pressure as specified in governing code.

1.12 PROTECTION OF ADJOINING PROPERTY

A. Adjoining public and private property shall be protected from damage during construction, remodeling and demolition work.
   1. Protection must be provided for footings, foundations, party walls, chimneys, skylights and roofs.
   2. Provisions shall be made to control water runoff and erosion during construction or demolition activities.
   3. Provide written notice to owners of adjoining buildings advising them that excavation is to be made and that adjoining buildings should be protected.
      a. Said notification shall be delivered not less than 10 days prior to the scheduled starting date of excavation.

1.13 TEMPORARY STORAGE AND STAGING AREAS

A. Construction equipment and materials shall be stored and placed so as not to endanger public, workers or adjoining property for duration of Project.

B. Temporary use of streets or public property for storage or handling of materials or of equipment required for construction or demolition, and the protection provided to the public shall comply with the provisions of the authority having jurisdiction.

C. Construction materials and equipment shall not be placed or stored so as to obstruct access to fire hydrants, standpipes, fire or police alarm boxes, catch basins or manholes, nor shall such material or equipment be located within 20 FT of a street intersection, or placed so as to obstruct normal observations of traffic signals or to hinder the use of public transit loading platforms.

D. Building materials, fences, sheds or any obstruction of any kind shall not be placed so as to obstruct free approach to any fire hydrant, fire department connection, utility pole, manhole, fire alarm box or catch basin, or so as to interfere with the passage of water in gutter. Protection against damage shall be provided to such utility fixtures during the progress of Work, but sight of them shall not be obstructed.

E. Prior to start of Work, meet with installers to arrange and prepare plot plan defining staging, storage, field office and traffic areas.
   1. Obtain Owner’s approval of plan.
   2. Except as specifically provided, working and storing outside these areas will not be permitted.
   3. Arrange and locate temporary structures and storage to avoid interfering with construction.

F. Within area designated for Contractor and Subcontractor's use, Contractor and Subcontractors provide suitable and sufficient enclosed and covered spaces, with raised flooring, to protect materials and equipment from damage by weather or construction work.
   1. Maintain storage and working areas in clean and orderly condition.

1.14 TEMPORARY FIRE EXTINGUISHERS

A. All structures under construction, alteration or demolition shall be provided with not less than one approved portable fire extinguisher and sized for not less than ordinary hazard as follows:
   1. At each stairway on all floor levels where combustible materials have accumulated.
   2. In every storage, construction shed and temporary construction office.
   3. Additional portable fire extinguishers shall be provided where special hazards exist, such as the storage and use of flammable and combustible liquids.

B. Provisions of the codes shall be strictly observed by Contractor to safeguard against all fire hazards attendant upon construction operations.

1.15 TEMPORARY STAIRWAYS

A. Provide stairways required for access and egress from construction.

B. Where a building has been constructed to a height greater than 50 FT or four stories, or where an existing building exceeding 50 FT in height is altered, at least one temporary lighted stairway shall be provided unless one or more of the permanent stairways are erected and lighted as construction progresses.

C. Required means of egress shall be maintained at all times during construction, demolition, remodeling or alterations and additions to any building.

1.16 FIRE PROTECTION STANDPIPES

A. Buildings four stories or more in height shall be provided with not less than one standpipe for use during construction.
   1. Such standpipes shall be installed where the progress of construction is not more than FT in height above the lowest level of fire department access.
   2. Such standpipe shall be provided with fire department hose connections at accessible locations adjacent to usable stairs.
   3. Such standpipes shall be extended as construction progresses to within one floor of highest point of construction having secured decking or flooring.
   4. Standpipes shall be either temporary or permanent in nature, and with or without a water supply, provided that such standpipes conform to the requirements of codes as to capacity, outlets and materials.
   5. Water supply for fire protection, either temporary or permanent, shall be made available as soon as combustible material accumulates.

1.17 AUTOMATIC SPRINKLER SYSTEM

A. In buildings where an automatic sprinkler system is required by this code, it shall be unlawful to occupy any portion of a building or structure until the automatic sprinkler system installation has been tested and approved.

B. Operation of sprinkler control valves shall be permitted only by properly authorized personnel and shall be accompanied by notification of duly designated parties.
   1. When sprinkler protection is being regularly turned off and on to facilitate connection of newly completed segments, the sprinkler control valves shall be checked at end of each work period to ascertain that protection is in service.

1.18 TEMPORARY FENCES AND BARRICADES

A. Contractor furnish, install and maintain all necessary sound temporary fences, barricades, trench and hole covers, warning lights and all other safety devices necessary to prevent injury to persons and damage to property.
   1. All entrance gates to the construction areas shall have padlocks manufactured by Knox keyed to the Fire Department keying system.
   2. Gates shall be 24 FT wide to facilitate Fire Department access.
   3. Fire Department apparatus shall be able to turn into construction site in one turn.

B. Contractor is responsible to design all construction barricades and fences with proper sizes of members and with adequate supports to protect public from injuries or accidents, arising from construction Work.

1.19 TEMPORARY ACCESS

A. Provide and maintain for duration of Work as required stairs, runways, guard rails, platforms, floor openings and similar temporary construction, as may be necessary for performance of construction operations. Such facilities shall be of type and arrangements as required for their specific use; shall be substantially constructed throughout, strongly supported, and well secured.

B. Permanent stairways may be used if adequately protected against damage.

C. Contractor's access to construction area will be permitted only through designated approaches in such a manner that traffic will not interfere with Owner's activities.

1.20 PROJECT SIGNS

A. Limit signs located on site to Contractor, Architect's, and Project Sign.
   1. Post no other signs on site except those required by law and those approved by Owner.
   2. Upon completion of the Work, or sooner if directed, remove project signs.

B. Provide Project Sign.
   1. Size: 4 x 8 FT.
   2. Material: Metal or wood frame, with 5/8 or 3/4 IN thick MDO exterior grade plywood surface.
   3. Support on two 4 x 6 IN x 12 FT treated wood posts, properly braced, set approximately 4 FT in earth and with bottom of sign approximately 4 FT above grade.
   4. Paint all surfaces of sign and frame with two coats of exterior paint and have professionally lettered thereon following information:
      a. Name of Project.
      b. Owner.
      c. Owner's logo.
      d. Architect.
      e. Architect's logo.
      f. Contractor.
      g. Mechanical installer.
      h. Electrical installer.
   5. Layout of sign shall be approved by Owner and Architect.

C. Install Architect's Sign on posts as described above.
   1. Sign furnished by Architect.

D. Locate signs on site where directed by Owner and Architect.

1.21 TEMPORARY SIGNAGE

A. Provide, maintain, and remove when no longer required, all temporary signage throughout Project, both interior and exterior, as may be required by prevailing code requirements and Authorities having jurisdiction.

1. Such signage shall include, but not be limited to, all signage as may be required for issuance of Certificates of Occupancy, both Temporary (TCO) and Final (C of O).

1.22 TEMPORARY PROTECTION

A. Protect Work in progress and adjoining materials in place, during handling and installation.

B. Supervise construction operation to assure that Work, completed or in progress, is not subject to harmful, dangerous, damaging or otherwise harmful exposure throughout construction period.
   1. Prevent accumulation of water on site:
      a. Remove standing water.
      b. Pump or direct away from site and adjoining property.
   2. Prevent accumulation of water on slabs, adjacent to building or foundations, or in utility trenches.
   3. Prevent damage to structural members.

C. Apply protective covering to assure protection of Work from damage or deterioration. Remove coverings at Substantial Completion.

D. Adjust, lubricate and maintain operable components to assure operability without damaging effects throughout construction period.

1.23 SECURITY

A. Provide security and facilities to protect Work and existing facilities and Owner's operations from unauthorized entry, vandalism or theft.

B. Coordinate with Owner's security program..

1.24 TEMPORARY ACCESS ROADS

A. Provide access on building site as required to perform Work.

B. Construction site access roads shall be maintained free of obstruction.

C. Clean up all debris, materials, etc., that falls from vehicles in route to and from site.

D. Do not block access to Owner’s facilities.

E. When this access is no longer required, restore to its original condition.

F. Provide means of removing mud from vehicle wheels before leaving site and entering public streets or Owner’s roads.

1.25 TEMPORARY PARKING

A. Contractor:
   1. Provide temporary parking areas to accommodate construction personnel.
   2. When site space is not adequate, provide additional off-site parking.
   3. Do not allow heavy vehicle or construction equipment on existing parking areas without Owner approval.

B. Construction personnel will not at any time park in any Owner parking lots or drives without prior express consent of Owner.

1.26 TRAFFIC CONTROL

A. Provide traffic control necessary to effect smooth Owner operations.

B. Provide and maintain adequate traffic control and flagmen’s services at points where transporting of equipment and materials engaged on Work, enters and exits from Project site and on site.

1.27 WASTE MANAGEMENT FACILITIES

A. Maintain facilities for separate collection of construction wastes and materials.

B. Conform with Waste Management Plan per Section 01 74 19.

1.28 COMPLETION OF WORK

A. Upon completion of Work or as progress of work dictates or sooner if directed by Owner or Architect, remove temporary facilities, and return improvements on or about site and adjacent property which are not shown to be altered, removed or otherwise changed; to condition which existed previous to starting Work.

END OF SECTION

SECTION 01 61 00
ACCEPTABLE MANUFACTURERS AND PRODUCTS

PART 1 - GENERAL

1.1 SUMMARY

A. Performance of product, material, or system is result of manufacturing, fabrication, installation procedures, use, and maintenance:
   1. Therefore, Architect endeavors to specify quality levels for products, materials, or systems that are advertised to conceptually meet performance goals and desired attributes for Project.
      a. For most conceptually equal systems and materials, the Architect may specify multiple manufactures.
      b. In some cases, based on quality and attribute goals for Project, number of manufacturers may be limited.

B. Product, material, or system substitutions:
   1. Prior to bid: See Section 00 26 00.
   2. After execution of the contract: See Section 01 25 13.

1.2 SPECIFYING METHODS AND PRODUCT OPTIONS

A. Method 1: Products are specified by naming two or more manufacturers. Substitutions are not permitted. Any one of manufacturers named may be used that meet specified requirements.

B. Method 2: Products are specified by naming one or more manufacturers. Substitutions are permitted. Any one of manufacturers named may be used that meet specified requirements. Submit a substitution request for any manufacturer not specifically named.

C. Method 3: Proprietary: No Substitutions. Products are specified by naming only one manufacturer.

D. Method 4: “Base” and “Optional”: Products are shown or specified by naming one manufacturer as Base, “Basis of Design” or “Design Standard”, with model numbers, dimensions or other identifying features. Other manufacturers are named as “Optional”, and will be considered under following conditions:
   1. Base manufacturer:
      a. Manufacturer listed as Base in Part 2 of specification section.
      b. Manufacturer listed as Base is particular manufacturer of a specific product used as basis of design.
   2. Optional manufacturer:
      a. Manufacturer listed as Optional in Part 2 of specification section.
      b. More than one manufacturer may be listed as Optional.
      c. Manufacturers listed as Optional are particular manufacturers of products similar to specific product used as basis of design.
      d. Listing manufacturer as Optional indicates acceptance of that manufacturer as supplier of a product, but only to extent product complies with specified requirements, including salient qualities provided by Base manufacturer's product.
         1) Salient qualities include, but are not necessarily limited to following:
            a) Purpose and function.
            b) Material and finish.
            c) Strength, durability and other applicable physical properties.
            d) Compatibility and performance attributes for indicated application.
            e) Capacity and operating characteristics, where applicable.

f) Size and configuration to extent required for fit with adjoining and adjacent conditions and within spatial limitations.
g) Appearance, including exposed dimensions, profile, texture, pattern and color, where visible to personnel in finished space, or from exterior.

e. Contractor is responsible for costs to provide dimensional, operational, structural, utility or any other related adjustments to fit an Optional manufacturer's product into Work.
f. See Section 01 33 00 Submittal Procedures, for Optional Product/System Comparison Form.

3. Base Product:
   a. Indicates specific product or system used, including specified attributes assigned to that product or system, as basis for design.
   b. Manufactures listed as Optional manufacturers may submit their equivalent products, but only if product complies with specified requirements, including salient qualities of Base Product.
      1) Products proposed by Optional manufactures must also comply with descriptive requirements listed in technical specification.
      2) Optional Products that obviously differ in appearance and quality of Base product will be rejected.
   c. Refer to specification sections for additional requirements.
4. Proposals shall be based on the Base Product.
5. Proposals may be based on any of the manufacturers listed, provided that a Substitution Request is submitted with Bid for the "Optional Product".

E. Method 5: Generic: Products are specified by reference standard , by performance, by description or by any combination of the three specifying methods. Products meeting or exceeding specification requirements may be used. Contractor assumes responsibility for compatibility of products selected.

1.3 DEFINITIONS

A. "Product(s)" means material, machinery, components, equipment, fixtures and systems forming Work. The term does not include machinery and equipment used for preparation, fabrication, conveying and erection of the Work. Products may also include existing materials or components required for reuse.

B. New Products: Items not previously incorporated into another project or facility, [except products consisting of recycled-content materials are allowed, unless explicitly stated otherwise]. Products salvaged or recycled from other projects are not considered new products.

END OF SECTION

SECTION 01 65 00

DELIVERY, HANDLING AND STORAGE: MATERIALS AND EQUIPMENT

PART 1 - GENERAL

1.1 JOB CONDITIONS

A. Comply with applicable codes.

B. Accomplish work to avoid damage to property.

C. Provide fire protection.

PART 2 - EXECUTION

2.1 PRODUCT DELIVERY

A. By manufacturer's normal means.

B. In original labeled containers.

C. Where applicable, with UL labeling on packages.

D. Contractor responsible for acceptance at site.

E. Schedule deliveries to avoid delaying Work, and to minimize space and duration of storage on site.

F. Sequence deliveries to avoid unnecessary additional construction of temporary protection.

G. Schedule and coordinate deliveries to avoid interference with Owner's operation.

H. Inspect items for damage upon delivery, reorder as required to avoid delays.

2.2 PRODUCT HANDLING AND STORAGE

A. Use methods to avoid damage to item or structure.

B. Protect weather fragile items from weather damage.

C. Handle and store bulk aggregates to avoid contamination.

D. Store to allow air circulation.

E. Store only in authorized areas.

F. Coordinate on site storage with Owner and other contractors working on site.

G. Replace or repair damaged items.

H. Uncrate, assemble if required, and remove debris.

I. When off-site storage is utilized, move items to site at no added cost.

2.3 CLEANUP

A. Remove excess materials from site.

B. Turn over to Owner, excess materials scheduled to remain.

C. Clean debris from site and storage area.

D. Restore site storage areas to original condition or as directed by Architect or Owner.

END OF SECTION

SECTION 01 73 29
CUTTING AND PATCHING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Cutting and Patching in accordance with provisions of Contract Documents.

B. This section covers cut and patch work either in remodel, add-on or new construction as necessary for execution of the Work.

C. Completely coordinate with the work of other trades.

1.2 QUALITY ASSURANCE

A. Employ skilled personnel to perform cutting and patching. Proceed with cutting and patching at the earliest feasible time and complete without delay.

B. Written Requests:
   1. Submit requests in advance of cutting or alteration which affects:
      a. Structural integrity of any component of Project.
      b. Integrity of weather-exposed or moisture-resistant component.
      c. Efficiency, maintenance, or safety of any operational component.
      d. Visual qualities of sight-exposed components.
      e. Work of Owner or separate contractor.
   2. Include in Request:
      a. Location and description of affected work.
      b. Necessity for cutting or alteration.
      c. Description of proposed work, and products to be used.
      d. Alternatives to cutting and patching.
      e. Effect on work of Owner or separate contractor.
      f. Written permission of affected separate contractor.
      g. Date and time work will be executed.

C. Requirements for Structural Work: Do not cut and patch structural elements in a manner that would change their load-carrying capacity or load-deflection ratio.
   1. Follow applicable NFPA Standards when torch cutting is required.

D. To the greatest extent practicable, employ original installer to perform cutting and patching for weather-exposed and moisture-resistant components, and sight-exposed surfaces. On existing work, employ persons experienced with material requiring cutting and patching.

E. Operational Limitations: do not cut and patch operating elements or related components in a manner that would result in reducing their capacity to perform as intended. Do not cut and patch operating elements or related components in a manner that would result in increased maintenance or decreased operational life or safety.

F. Visual Requirements: Do not cut and patch construction exposed on exterior or in occupied spaces in a manner that would, in Architect's opinion, reduce the building's aesthetic or visual qualities. Do no cut and patch construction in a manner that would result in visual evidence of cutting and patching. Remove and replace construction which was cut and patched in a visually unsatisfactory manner.

G. Warranty or existing warranties: Replace, patch, and repair material and surfaces cut or damaged by methods and with materials in such a manner as not to void any warranties required or existing.

1.3 DESCRIPTION

A. Install Work in such a manner and sequence as to preclude or minimize cutting and patching of new Work.

B. Execute cutting (including excavation), fitting or patching of Work, required to:
   1. Make several parts fit properly.
   2. Uncover Work to provide for installation of ill timed Work.
   3. Remove and replace defective Work.
   4. Remove and replace non-conforming Work.
   5. Remove samples of installed Work for testing.
   6. Install specified Work in existing construction.
   7. Provide rerouting penetrations of non-structural surfaces for installation of piping and electrical conduit.
   8. Patch and repair fireproofing damaged after installation of other Work or demolition activities.
   9. Remove and finish construction at connections to other structures.
   10. Remove existing roofing where required by new Work, and patch to match existing roofing.

C. Do not endanger any Work or any Work of other Contractors, by cutting, excavating, or otherwise altering any Work except with written consent of Contractor subject to review by Architect.

D. Do not cut into or cut away any structural concrete or other structural members, any other concrete nor dig under any foundations or into structural walls or other parts, or in any case allow same to be done without full knowledge and written consent of Architect.

E. Be responsible for damage resulting from violation of these provisions.

F. Use only firms or individual trades qualified to perform Work required under this Section.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Sleeve and Opening Drawings: For only those conditions specified submit dimensioned drawings showing position and size of sleeves and openings in relation to equipment, other structural and non-structural assemblies, and with reference to dimensional grid of building.

1.5 JOB CONDITIONS

A. Before start of Work, obtain and pay for all permits required by all authorities having jurisdiction and notify all interested utilities companies.

B. Obtain approval of Owner and authorities having jurisdiction for Work which affects existing exitways, exit stairs, means of egress, or access to, or exit from, areas.
   1. Review with and obtain approval of authorities for any temporary construction which affects such areas.

C. Protect existing construction during cutting and patching to prevent damage. Provide protection from adverse weather conditions for portions of Project that might be exposed during cutting and patching operations.

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

E. Avoid cutting existing utilities, pipe, conduit, or ductwork serving the building but scheduled to be removed or relocated until alternate provisions have been provided.

F. Items to be salvaged and delivered to Owner shall be carefully removed and properly stored in an area easily accessible for removal by Owner.

1.6 PAYMENT FOR COSTS

A. Costs caused by non-coordinated or defective Work, or Work not conforming to Contract Documents, paid by Contractor responsible for non-coordinated, rejected, or non-conforming Work.

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Use materials identical to existing materials.

B. For exposed surfaces, use materials that visually match existing adjacent surfaces, use materials that visually match existing adjacent surfaces to the fullest extent possible if identical materials are unavailable or cannot be used.

C. Use materials whose installed performance will equal or surpass that of existing materials.

D. Where applicable, comply with specifications for type of Work to be performed.

PART 3 - EXECUTION

3.1 INSPECTION

A. Prior to the bid, review all existing facilities that are related to this contract and shall be familiar with all utility requirements and construction.
   1. Existing facility documents may be available through the Owner for review.

B. Perform preliminary investigations as required to ascertain extent of Work.
   1. Conditions which would be apparent by such investigation will not be allowed as cause for claims for extra costs.

C. Inspect existing conditions for work, including elements subject to movement or damage during:
   1. Cutting and patching.

D. If unsafe or unsatisfactory conditions are encountered, take corrective action before proceeding.

E. Before proceeding, meet at Project Site with parties involved in cutting and patching, including mechanical and electrical trades.
   1. Review areas of potential interference and conflict.
   2. Coordinate procedures and resolve potential conflicts before proceeding.

F. After uncovering existing conditions for Work, inspect conditions affecting installation of new products or Work.

3.2 PREPARATION PRIOR TO CUTTING

A. Provide adequate shoring, bracing and support as required to maintain structural integrity of Project.

B. Provide protection for other portions of Project which may be affected.

C. Provide protection from elements when required.

D. Avoid interference with use of adjoining areas or interruption of free passage to adjoining areas.

E. Existing Utility Services and Mechanical/Electrical Systems: Where existing services/systems are required to be removed, relocated, or abandoned, bypass such services/systems before cutting to prevent interruption to occupied areas.

F. Maintain excavations free of water.

3.3 CUTTING AND REMOVAL - GENERAL

A. Execute fitting and adjustment to provide finished installation to comply with specified tolerances and finishes.

B. Execute cutting by methods which will prevent damage to existing or other Work and will provide proper surfaces to receive installation of new Work.

C. Neatly cut and remove materials, and prepare all openings to receive new work.

D. Remove masonry or concrete in small sections.

E. Provide shoring, bracing, and other supports to prevent movement, settlement, or collapse of remaining or adjacent wall areas, structure, or facilities.

F. Arrange shoring, bracing, and supports to prevent overloading of structure.

G. Take all precautions necessary to prevent damage to existing remaining work or to adjacent facilities.

H. Execute Work using methods which will prevent interference with use of remaining and adjacent facilities by Owner.

I. Remove existing work indicated to be removed, or as necessary for installation of new Work.

J. Provide for cutting, fitting, repairing, patching and finishing of Work disturbed by installation of new Work.

K. Do not remove or damage fireproofing materials.
   1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
   2. Repair or replace damaged fireproofing.

3.4 CUTTING

A. Cut existing construction to:
   1. Provide for installation of other components or performance of other construction activities, and subsequent fitting and patching to restore surfaces to their original condition.
   2. Fit products together, to integrate with other work.
   3. Uncover work to install ill-timed work.
   4. Remove and replace defective and non-conforming work.
   5. Provide openings for mechanical and electrical penetrations.

B. Cut existing construction using methods least likely to damage components to be retained or adjoining construction. Where possible, review proposed procedures with original installer. Comply with original installer's recommendations.
   1. In general, where cutting is required, use hand or small power tools designed for sawing or grinding, not hammering and chopping. Cut holes and slots neatly to size required, with minimum disturbance of adjacent surfaces. Temporarily cover openings when not in use.
   2. To avoid marring existing finished surfaces, cut or drill from exposed or finished side into concealed surfaces.
   3. Cut through concrete and masonry using a carborundum saw or diamond core drill.
   4. Comply with requirements of applicable Sections of Division 31, where cutting and patching requires excavating and backfilling.
   5. Where portions of utility services are shown or required to be removed, relocated or abandoned, bypass those portions shown to remain before cutting. Cut off pipe or conduit in walls or partitions to be removed. Cap, valve or plug and seal the remaining portion of pipe or conduit to prevent entrance of moisture or other foreign matter after bypassing and cutting.

3.5 CUTTING IN CONCRETE CONSTRUCTION

A. Do not cut into nor core drill openings or holes in beams, joists, and columns without prior written approval of Architect.

1. When written approval is obtained, comply with additional requirements and instructions of Architect.

B. In members other than beams, joists, and columns; where an opening larger than 10 IN in any dimension is required, or where dimension between 2 openings in less than 2 times maximum dimension of largest opening, and condition is not shown on architectural or structural drawings, obtain prior written approval of Architect.
   1. At floor slabs and walls to be core drilled or cut, find and mark all reinforcing in both faces located by means of x-ray, ground penetrating radar, pach-ometer, or prof-ometer. Submit sketch showing location of rebar and proposed cuts or cores for review.
   2. When written approval is obtained, comply with additional requirements and instructions of Architect.

3.6 CUTTING IN POST TENSIONED CONCRETE CONSTRUCTION

A. Do not cut into nor core drill openings or holes in beams or joists.

B. Do not cut into nor core drill openings or holes in slabs without prior written approval of Architect.
   1. When approval is obtained, comply with additional requirements and instructions of Architect.

C. Openings not greater than 6 IN in any dimension are permitted in flat slab portions of construction except that such openings shall not interfere with or disturb strands.
   1. Do not place closer than 12 IN to any column face, or closer than 24 IN to any post tensioning strand anchor.

D. Do not install any trenched duct electrical systems.

3.7 CUTTING IN PRECAST/PRESTRESSED CONCRETE CONSTRUCTION

A. Do not cut openings or core drill vertically or horizontally through stems of members.

B. Openings smaller than 6 IN diameter or 6 IN maximum dimension may be cut in flanges of units after obtaining prior written approval of Architect.
   1. When approval is obtained, comply with instructions of Architect.

3.8 CUTTING IN STEEL FRAME AND METAL DECK CONSTRUCTION

A. Do not cut nor drill holes in webs and flanges of columns, beams, purlins, and joists without prior written approval of Architect.
   1. When approval is obtained, comply with requirements and instructions of Architect and provide reinforcing at such locations when required.

B. When openings are cut into metal decks having cast-in-place concrete slab over metal deck:
   1. No reinforcing of holes is required for circular openings or sleeves up to 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
   2. Reinforce openings greater than 6 IN.
   3. Obtain prior written approval of Architect for openings not shown on architectural or structural drawings.
      a. Comply with additional requirements and instructions of Architect.

C. When openings are cut into metal roof decks that have no concrete cast-in-place (except lightweight insulating cementitious roof fill) over deck:
   1. No reinforcing of holes is required for circular openings less than 6 IN diameter and for rectangular openings having no side dimension greater than 6 IN.
   2. Reinforce openings between 6 IN and 12 IN, with 20 GA flat steel sheet 12 IN greater in dimension than opening; fusion weld to top surface of deck at each corner and on each side midway between corners.
   3. Do not cut openings greater than 12 IN without prior written approval of Architect.
      a. Comply with requirements and instruction of Architect.

3.9 MATCHING AND PATCHING

A. Where items are removed from existing walls, ceilings, floors or partitions to remain, repair wall, ceiling, floor or partition disturbed by removal.

B. Where walls, ceilings, floors or partitions are removed, repair abutting walls, ceilings or floors disturbed by removal.

C. Where existing construction is cut, removed or otherwise disturbed to permit installation of new Work, match and patch existing disturbed construction.

D. Use methods and materials similar in appearance, and equal in quality to areas or surfaces being repaired.

E. Restore Work which has been cut or removed; install new products to provide completed Work in accord with requirements of Contract Documents.

F. Patch Work must in every way possible match existing work and adjacent surfaces.

G. Refinish entire surfaces as necessary to provide an even finish to match adjacent finishes.
   1. Refinish continuous surfaces to nearest intersections.
   2. Assembly - entire refinishing.

H. In existing areas remove and replace existing ceilings and finishes for installation of Work, if not shown to be removed on Architectural Drawings and Schedules.
   1. If existing ceiling can not be satisfactorily reinstalled, replace with like materials and construction.
   2. Replace damaged construction with like materials.

I. At penetrations of fire-rated walls and partitions, [smoke partitions,] ceiling or floor construction, provide firestopping in accordance with Section 07 84 00.

END OF SECTION

SECTION 01 74 23
CLEANING

PART 1 - GENERAL

1.1 FIRE PROTECTION

A. Store volatile waste in covered metal containers.

B. Remove from premises daily.

1.2 POLLUTION CONTROL

A. Conduct cleanup and disposal operations to comply with codes, rules, regulations, ordinances, and anti-pollution laws.

B. Do not burn or bury rubbish and waste on site.

C. Do not discharge volatile, harmful, or dangerous materials into drainage systems.

PART 2 - PRODUCTS

2.1 CLEANING MATERIALS

A. Use materials recommended by manufacturers of surfaces to be cleaned.

B. Use cleaning materials only on surfaces recommended by cleaning material manufacturer.

C. Use only those cleaning materials which will not create hazards to health or property and will not damage surfaces.

2.2 CLEANING MATERIALS

A. Use only those cleaning materials which will not create hazards to health or property, are non-toxic to both humans and aquatic life, and will not damage surfaces, and comply with the following:

PART 3 - EXECUTION

3.1 GENERAL

A. Clean all items installed under this Contract.
   1. Leave free of stains, dirt, dust, damage, or defects.
   2. Include washing, sweeping, polishing of wall surfaces, floors, windows, hardware, mirrors, lighting fixtures, equipment, etc.

3.2 DURING CONSTRUCTION

A. Provide on-site containers for the collection of waste materials, debris, and rubbish.

B. Clean up all waste materials, rubbish, and debris from site and access daily. The construction site must be clean and presentable at the end of each work day.
   1. Dispose of off site once a week or as required by Owner.

C. Wet down dusty materials and rubbish to prevent blowing dust during entire construction period.
   1. If use of water is prohibited by law, seek an alternate method to prevent blowing dust.

D. Perform cleaning operations as required during construction to prevent accumulations of dust, soil, and debris.

E. Clean and protect Work in progress and adjoining materials in place, during handling and installation.

F. Clean and vacuum interior space prior to start of painting, and continue cleaning until painting is completed.

G. Schedule cleaning operations so contaminants do not fall on wet painted surfaces.

H. Clean and provide maintenance on completed Work as frequently as necessary through out construction period.

I. Clean lunch/break area after each use.

J. Maintain site and building so no condition provides a fire hazard.

K. Remove snow and ice from accesses to buildings.

3.3 FINAL CLEANING

A. At Substantial Completion, perform final cleaning of Work and existing areas wherever any area are left less than clean by construction operations.
   1. Complete cleaning operations before requesting review for Substantial Completion.

B. Use experienced workmen or professional cleaners for final cleaning.

C. Repair and touch-up marred areas.

D. Broom clean and remove stains from paved surfaces; rake clean other surfaces of grounds.

E. Replace air conditioning filters in units operated during construction.

F. Clean ducts, blowers, and coils in air conditioning units operated during construction.

G. Remove grease, dust, dirt, stains, labels, fingerprints, mastic, adhesive, and foreign materials from interior and exterior surfaces, and fixtures, hardware, and equipment.

H. Remove temporary protection and facilities installed for protection of the Work during construction.

I. Wash and shine glazing, mirrors, stainless steel, etc., including existing windows in area of construction.

J. Prior to Owner occupancy, Contractor and Owner shall conduct an inspection of interior and exterior surfaces and Work areas to verify Project is clean to Owner's satisfaction.

END OF SECTION

SECTION 01 77 00
CONTRACT CLOSEOUT (GC)

PART 1 - GENERAL

Provisions followed by an asterisk (*) include some or all provision as obtained from AIA Document A201 - General Conditions of the Contract for Construction.

1.1 SUBMITTALS

A. Contract closeout information:
   1. For substantial completion:
      a. Comprehensive list of all items to be completed or corrected.
      b. Contractor's Notice of Substantial Completion.
      c. Certificates of governing authorities.
      d. Submittals required by other Sections.
   2. For final completion:
      a. Contractor's Certificate of Completion.
      b. Evidence of payments and release or waiver of liens in triplicate.
         1) Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
         2) Contractor's Affidavit of Release of Liens: AIA Document G706A.
         3) Contractor's release or waiver of liens.
         4) Separate releases or waivers of liens for subcontractors, suppliers, and others with lien rights against Owner, together with list of all such parties.
         5) If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
      c. Consent of Surety (if any) to Final Payment: AIA Document G707.
      d. Certificates evidencing that insurance to remain enforce.
      e. Final application for payment.
      f. Initialed list(s) of items to be completed or corrected verifying completion of each items.
      g. List of Subcontractors and equipment suppliers. Include:
         1) Name.
         2) Address.
         3) Telephone number.
         4) Representative.
      h. List of sales and services taxes.
      i. Letter of site conformance.
      j. Closeout submittals required by other Sections.

1.2 SUBSTANTIAL COMPLETION

A. Substantial Completion is the stage in the progress of Work when the Work or designated portion thereof is sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work for its intended use. *
   1. Work will not be considered for Substantial Completion until all systems and equipment are operational; all designated or required governing agency inspections and certifications have been made and posted, instruction of designated Owner's personnel in operation of systems and equipment has been completed, operation and maintenance data has been satisfactorily turned over to Owner, and finishes are in place. In general, the only remaining Work shall be minor in nature, such that Owner may occupy or utilize Work or designated portion there of, and completion or correction of Work by Contractor would not materially interfere or hamper Owner's intended business use or operation.

2. Contractor shall certify that all remaining Work will be completed within 30 consecutive calendar days following date of Substantial Completion, or as agreed to in writing, and failure to do so shall automatically reinstate provisions for damages due Owner as contained elsewhere in Contract Document or as provided by law for such period of time as may be required by Contractor to fully complete Work whether Owner has occupied Work or not.

B. Obtain evidence of compliance with requirements of governing authorities:
   1. Certificates of inspection of:
      a. Mechanical.
      b. Electrical.
      c. Plumbing.
      d. Fire protection and life safety systems.
      e. Elevators.
      f. Etc.
   2. Health Department and other governing authorities as required.
   3. Certificate of Occupancy.

C. When Contractor considers that Work, or a portion thereof which Owner agrees to accept separately, is substantially complete, Contractor shall thoroughly inspect Work, and prepare and submit to Architect a comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion (utilize form at end of this Section). *

D. Contractor certify that:
   1. Work performed under this Contract has been thoroughly inspected and considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work for its intended use.

E. Failure of Contractor to include an item on such list(s) does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents. *

F. Contractor shall proceed promptly to complete and correct the items on list.

G. After receipt of Contractor's comprehensive list of items to be corrected or completed, and Contractor's Notice of Substantial Completion, Architect and Owner will, within reasonable period after notification, review list of items to be completed or corrected, or inspect Work, or designated portion there of, to determine whether Work is Substantially Complete. *

H. If Architect's or Owner's review or inspection discloses any item, whether or not included on Contractor's list, which is not sufficiently complete in general accordance with Contract Documents so Owner can occupy or utilize Work or designated portion thereof for its intended use: *
   1. Contractor will be notified stating reasons.
   2. Contractor shall substantially complete or correct Work.
   3. Contractor shall thoroughly re-inspect Work.
   4. Contractor shall submit another Contractor's Notice of Substantial Completion, a revised list of items to be completed or corrected, and a request for another review.
   5. Architect and Owner will again review list of items to be completed or corrected and Work.

I. If Contractor prematurely submits a Contractor's Notice of Substantial Completion or requests Architect's review of Work, and Architect determines that Project or designated portion thereof is not Substantially Complete, Architect may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.

J. Architect will not perform more reviews of sub-projects or phases than number indicated in Contract Documents or Owner – Architect Agreement, unless otherwise mutually agreed to by Architect and Owner.

K. When Work or designated portion there of is considered Substantially Complete, Architect will prepare a Certificate of Substantial Completion.

1. The Certificate of Substantial Completion shall establish date of Substantial Completion, shall establish responsibilities of Owner and Contractor for security, maintenance, heat, utilities, damage to Work and insurance, and shall fix time within which Contractor shall complete and correct Work.
2. Warranties and guarantees required by Contract Documents shall commence on date of Substantial Completion of Work or designated portion thereof unless otherwise provided in Certificate of Substantial Completion.
3. The Certificate of Substantial Completion shall be submitted to Owner and Contractor for their written acceptance of responsibilities assigned to them in such Certificate. *

L. Owner may occupy Project, or designated portion thereof, under provisions agreed to in Certificate of Substantial Completion, and if required, a certificate of occupancy has been issued by governing authorities.
   1. If Owner is going to occupy Project, or designated portion thereof, Contractor shall perform final cleaning immediately.
   2. If Owner or Architect discovers any Work which is not complete and/or is not in conformance with Contract Documents, during or after occupying or utilizes Work, whether included on a list or not, Owner shall notify Contractor to complete or correct item(s) identified.

M. Contractor shall proceed expeditiously with adequate forces to complete or correct Work, and to complete all Project closeout requirements within designated time.

1.3 FINAL COMPLETION

A. After Contractor has completed all Work, and has thoroughly inspected Work to determine that it is sufficiently complete, is in general accordance with Contract Documents, and Contract is fully performed, Contractor shall submit Contractor's Certificate of Completion to Architect, and the list(s) of items to be completed or corrected initialed to indicate Contractor has verified completion of each item. * Utilize form at end of this section. Contractor certifies that:
   1. Work has been thoroughly inspected by Contractor for compliance with Contract Documents.
   2. Work has been completed in accordance with Contract Documents.
   3. Equipment and systems have been tested and are operating satisfactorily.
   4. Contract closeout requirements have been completed satisfactorily and submitted.
   5. Contractor knows of no reason that insurance will not be renewable to cover period required by Contract Documents.
   6. Work is ready for final inspection and acceptance.

B. Contractor submit final closeout submittals required by this and other Sections.

C. Owner and Architect will make final walk through within a reasonable time after receipt of Contractor's Certificate of Completion and final Application for Payment. *
   1. If Contractor prematurely submits a Contractor's Notice of Final Completion or requests Architect's final review of Project, and Architect determines that Project is not satisfactorily complete, Architect may invoice Owner as a change in services for such cost involved in evaluating and reviewing Work, and associated travel costs. Contractor shall reimburse Owner for such costs.

D. Contractor shall remedy any remaining deficiencies or incomplete Work, at Contractor's expense.

E. When Owner and Architect finds Work acceptable under Contract Documents and Contract satisfactorily performed, Architect will promptly issue a final Certificate for Payment. *

F. Neither final payment nor any remaining retained percentage shall become due until Contractor submits to Architect;
   1. an affidavit that payrolls, bills for materials and equipment, and other indebtedness connected with Work for which Owner or Owner's property might be responsible or encumbered (less amounts withheld by Owner) have been paid or otherwise satisfied (AIA Documents G706 and G706A),
   2. a certificate evidencing that insurance required by Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least 30 days' prior written notice has been given to Owner,
   3. a written statement that Contractor knows of no substantial reason that insurance will not be renewable to cover period required by Contract Documents,
   4. consent of surety, if any, to final payment (AIA Document G707),
   5. Contractor's and Subcontractor's final release or waiver of liens,
   6. if required by Owner, other data establishing payment or satisfaction of obligations, such as receipts, releases and waivers of liens, claims, security interests or encumbrances arising out of Contract, to extent and in such form as may be designated by Owner, for Owner's review, and
   7. if a Subcontractor refuses to furnish a release or waiver required by Owner, Contractor may furnish a bond satisfactory to Owner to indemnify Owner against such lien. If such lien remains unsatisfied after payments are made, the Contractor shall refund to Owner all money that Owner may be compelled to pay in discharging such lien, including all costs and reasonable attorneys' fees. *

G. If Substantial Completion or Final Completion is delayed through no fault of Owner or Architect, Architect may invoice Owner as a change in services for such costs, and associated travel costs. Contractor shall reimburse the Owner for such costs.

END OF SECTION

CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

PROJECT: _____

ARCH PROJ. NO.: _____ CONTRACT DATE:
CONTRACT FOR: _____

WORK OR DESIGNATED PORTION SHALL INCLUDE: _____

Work performed under this Contract has been thoroughly inspected and is considered to be sufficiently complete, in accordance with Contract Documents, so Owner can occupy or utilize Work or designated portion thereof for its intended use.

- ❑ Certificates of inspections indicating compliance with requirements of governing authorities, are attached hereto.
- ❑ Certificate of Occupancy have been obtained from governing authorities, are attached hereto.
- ❑ A comprehensive list of items to be completed or corrected, prepared by Contractor is attached, hereto. Failure to include any items on such list does not alter responsibility of Contractor to complete all Work in accordance with Contract Documents.

Contractor will complete or correct Work by: _____

CONTRACTOR: _____
BY: _____ DATE: _____

OWNER (agrees) (does not agree) to accept portion designated above separately from rest of Project.

Owner intends to utilize, occupy or take use on: _____

OWNER: _____
BY: _____ DATE: _____

The Work designated above, has been determined to be:

- ❑ Substantially Complete and a Certificate of Substantial Completion will be issued.
- ❑ Not substantially complete for following reasons: _____

ARCHITECT: HDR Architecture, Inc.
BY: _____ DATE: _____

DISTRIBUTION: ❑ OWNER ❑ ARCHITECT ❑ CONTRACTOR

END OF CONTRACTOR'S NOTICE OF SUBSTANTIAL COMPLETION

CONTRACTOR'S CERTIFICATE OF COMPLETION

PROJECT: _____
ARCH. PROJECT NUMBER: _____
CONTRACT FOR: _____
CONTRACT DATE: _____

This is to certify that I am an authorized official of, and have been properly authorized by said firm or corporation to certify following:
I know of my own personal knowledge, and do hereby certify on behalf of Contractor,
that Work has been reviewed and thoroughly inspected for compliance with Contract Documents,
that Work has been completed, in accordance with Contract Documents and Contract is fully performed,
that all equipment and systems have been tested and are operating satisfactorily,
that all Contract closeout requirements have been completed satisfactorily and submitted,
know of no substantial reason that insurance will not be renewable to cover period required by Contract Documents, and Work is ready for final inspection and acceptance.

Attached are three (3) copies of following documents, which are required prior to final payment:

- ❑ Final Application for Payment.
- ❑ Contractor's Affidavit of Payments of Debts and Claims: AIA Document G706.
- ❑ Contractor's Affidavit of Release of Liens: AIA Document G706A.
- ❑ Contractor's Final Release or Waiver of Liens.
- ❑ Consent of Surety (if any) to Final Payment: AIA Document G707.
- ❑ Certificate evidencing that insurance required by the Contract Documents to remain in force after final payment is currently in effect and will not be canceled or allowed to expire until at least thirty (30) days' prior written notice has been given to Owner.
- ❑ The list(s) of if items which were to be completed and corrected, with each item initialed to indicate Contractor has verified completion or correction of each.
- ❑ List of subcontractors and equipment suppliers.
- ❑ Certified list of all sales and service taxes paid.
- ❑ Letter of site conformance by licensed surveyor.
- ❑ If required by Owner, other data establishing payment or satisfaction of obligations arising out of Contract.
- ❑ Bond satisfactory to Owner to indemnify Owner against liens from Subcontractors.
- ❑ Transmittal indicating Owner has received Project Record Documents.

I understand that acceptance of final payment by Contractor, a Subcontractor or material supplier shall constitute a waiver of claims by that payee except those previously made in writing and identified by that payee as unsettled at time of final Application for Payment.

CONTRACTOR: _____ BY: _____

TITLE: _____ DATE: _____

Subscribed and sworn to me this _____ day of _____ _____

NOTARY PUBLIC: _____

_____

My commission expires: _____

DISTRIBUTION: ❑ OWNER ❑ ARCHITECT

END OF CONTRACTOR'S CERTIFICATE OF COMPLETION

SECTION 01 78 23
OPERATION AND MAINTENANCE DATA

PART 1 - GENERAL

1.1 SUBMITTALS

A. Contract Closeout Information:
   1. Submit operation and maintenance data directly to Owner.
   2. Submittal to Architect is not required.

PART 2 - PRODUCTS

2.1 OPERATION AND MAINTENANCE MANUALS

A. Assemble data indicated and data required to completely describe operation and maintenance procedures.

B. Assemble information in form of a multiple file composite electronic PDF file for each manual type required.
   1. Index files by specification section, with each item clearly labeled.
   2. Identify each volume with Project name and contents.
   3. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.
   4. Where applicable, clarify and update reviewed manual content to correspond to revisions and field conditions.

C. Use electronic files prepared by manufacturer where available.
   1. Scan paper documents and configure scanned file for minimum readable file size.

D. Include each item on Table of Contents.

2.2 DATA REQUIRED FOR EQUIPMENT AND SYSTEMS

A. Sequence of Operation:
   1. List valves, switches, etc., used to start, stop and adjust systems.
   2. Provide flow diagrams, control sequences and valve directory.
   3. Submit valve directory for review prior to inclusion in manual:
      a. Show valve number, location.
      b. List equipment controlled.

B. Lubrication Instructions:
   1. Frequency of inspection and lubrication recommended.
   2. Type of grease.
   3. Amount of lubrication recommended.

C. Maintenance and Troubleshooting Data:
   1. Manufacturer furnished data.
   2. Project record wiring diagrams.
   3. Name and address of manufacturer.
   4. Name and address of local representatives who stock or distribute repair parts.

2.3 DATA REQUIRED FOR FINISH MATERIALS

A. Maintenance Data:
   1. Precautions necessary.
   2. Manufacturer's instructions and recommendations.
   3. Maintenance materials and tools required.
   4. Repair and/or replacement instructions.

5. Name and address of manufacturer.
6. Name and address of local supplier of materials.

PART 3 - EXECUTION

3.1 DELIVERY

A. Deliver electronic copies to Owner sixty (60) days prior to Owner instruction of systems and equipment, and substantial completion.

B. Use Operation and Maintenance Data Transmittal form at end of this Section.

C. Acquire Owner's acceptance of items listed on transmittal form.

D. Forward copy of transmittal form with Owner's acceptance to Architect.

END OF SECTION

OPERATION AND MAINTENANCE DATA TRANSMITTAL

Project:

To Owner: **Date:**

From C.M./Contractor:

Assemble data required to describe operation and maintenance procedures. Deliver as an indexed electronic PDF file. Include name, address, and phone number of closest supplier for each item.

Section	Description	Quantity

Owner's Verification and Acceptance

Accepted by: _____ **Date:** _____

Forward copy of this transmittal to the Architect.

DISTRIBUTION: ☐ OWNER ☐ CONTRACTOR ☐ C. M. ☐ ARCHITECT

END OF TRANSMITTAL

SECTION 01 78 26

INTERIOR FINISH FIRE PERFORMANCE DATA

PART 1 - GENERAL

1.1 SUBMITTALS

A. Contract Closeout Information:
   1. Copy of transmittal letter indicating Owner's acceptance to Architect.

PART 2 - PRODUCTS

2.1 INTERIOR FINISH FIRE PERFORMANCE DATA MANUALS

A. Assemble data indicated and other data required to completely describe operation and maintenance procedures.

B. Assemble in 3-ring binders, completely indexed by specification section, with each item clearly labeled. Identify each volume with Project name and contents.

C. Identify each item in manner consistent with names and identification numbers used in Contract Documents, not with manufacturer's catalog numbers.

D. Neatly type data not furnished in printed form.

E. Organize data for ease of reference with indexed tabs.

F. Included each item on table of contents.

2.2 DATA REQUIRED FOR FINISH MATERIALS

A. Interior finish fire performance data:
   1. Provide for each interior finish and furnishing material and type specified:
      a. Manufacturer's printed information including:
         1) Fire class.
         2) NFPA test number.
   2. Materials:
      a. Flooring,
      b. Wall covering.
      c. Ceiling,
      d. Window treatment.

PART 3 - EXECUTION

3.1 DELIVERY

A. Deliver two copies to Owner 60 days prior to Owner instruction of systems and equipment, and substantial completion.

B. Use Interior Finish Fire Performance Data Transmittal form at end of this Section.

C. Acquire Owner's acceptance of items listed on transmittal form.

D. Forward copy of transmittal form with Owner's acceptance to Architect.

END OF SECTION

INTERIOR FINISH FIRE PERFORMANCE DATA TRANSMITTAL

Project:

To Owner: Date:

From C.M./Contractor:

Contractor shall assemble data required to describe fire performance of each interior finish and furnishing material. Index and bind in 3-ring binders. Include name, address, and phone number of manufacturer for each item.

DATA TURNED OVER TO OWNER

SECTION	DESCRIPTION	BINDER

OWNER'S VERIFICATION AND ACCEPTANCE

Accepted by: _____ Date: _____

Forward copy of this transmittal to the Architect.

DISTRIBUTION: ☐ OWNER ☐ CONTRACTOR ☐ C. M. ☐ ARCHITECT

END OF TRANSMITTAL

SECTION 01 78 36
WARRANTIES AND GUARANTEES

PART 1 - GENERAL

1.1 DESCRIPTION

A. Execute and provide notarized Project Warranty on form furnished at end of section.

B. Provide special written warranties or guarantees or both for products, equipment, systems and installations required by other sections of Contract Documents for duration indicated.

C. Provide manufacturer's warranties or guarantees or both for products, equipment, systems and installations required by other sections of Contract Documents for duration indicated.
   1. Where manufacturer's standard warranties or guarantees or both expire before duration required by other sections of Contract Documents, obtain and pay for extensions as part of Contract Price.

D. Provide all warranties or guarantees or both prior to final payment.

E. Warranties or guarantees or both required by Contract Documents shall commence on date of Substantial Completion of Work, or designated portion thereof, unless otherwise indicated in Certificate of Substantial Completion.

1.2 SUBMITTALS

A. Contract Closeout Information:
   1. Full executed and notarized Project Warranty on included form.
   2. Transmittal letter indicating Owner's receipt of 3-ring binder containing all product equipment and system warranties or guarantees or both required by other sections of Contact Documents.

1.3 JOB CONDITIONS

A. If for any reason, Contractor cannot warrant or guarantee or both any portion of Work using products or construction methods indicated or required by other sections of Contract Documents, notify Architect in writing during bid period, and before contracts are awarded, indicating reasons and names of products and data on substitutions that can be warranted or guaranteed or both.
   1. Should Contractor fail to notify Architect, Contractor will be considered as having agreed to warrant or guarantee or both for Work indicated.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 PROJECT WARRANTY

A. Execute and provide notarized Project Warranty on form furnished at end of section.
   1. Provide Contractor's name, address, signature and date.
   2. Notarial Act and notarization: Warranty document is required to be signed, dated, and sealed with Notary Public seal or stamp in accordance with state and territorial notary laws.

3.2 PRODUCT, EQUIPMENT & SYSTEM WARRANTIES AND GUARANTEES

A. Compile approved warranties and guarantees or both required by other sections of Contract Documents.

B. Bind or assemble in 3-ring binders, completely indexed by specification section, with each warranty or guarantee or both clearly labeled.

C. Identify each warranty or guarantee or both in manner consistent with names and identification numbers used in Contract Documents.

D. Neatly type or draft all warranties or guarantees or both not furnished in printed form.

E. Provide transmittal letter containing:
   1. Date
   2. Project title
   3. Contractor's name and address
   4. Title and number of warranties or guarantees or both
   5. Indication of Owner's receipt

F. Deliver to Owner prior to final payment with copy of transmittal letter indicating Owner's receipt.

END OF SECTION

PROJECT WARRANTY

PROJECT: PROJECT NO.: 010249/241937
Courthouse
Renovation
Project
OWNER:

DATE OF SUBSTANTIAL COMPLETION:
As indicated on Certificate of Substantial Completion

Contractor, warrants to Owner that Work is free from defects not inherent in the quality required or permitted, and that Work conforms with requirements of Contract Documents. Work not conforming to these requirements, including substitutions not properly approved and authorized, may be considered defective. Contractor's warranty excludes remedy for damage or defect caused by abuse, modifications not executed by Contractor, improper or insufficient maintenance, improper operation, or normal wear and tear under normal usage.

If, within one-year after the date of Substantial Completion of Work or designated portion thereof, or by terms of an applicable special warranty required by Contract Documents, any of the Work is found to be not in accordance with requirements of Contract Documents, the Contractor shall correct it promptly after receipt of written notice from Owner to do so unless Owner has previously given Contractor a written acceptance of such condition. Owner shall give such notice promptly after discovery of the condition.

The above shall not be construed to establish a period of limitation with respect to other obligations which Contractor might have under Contract Documents. Establishment of one-year period for correction of Work relates only to specific obligation of Contractor to correct Work, and has no relationship to time within which obligation to comply with Contract Documents may be sought to be enforced, nor to time within which proceedings may be commenced to establish Contractor's liability with respect to Contractor's obligations other than specifically to correct Work.

CONTRACTOR:
ADDRESS:

BY: SIGNATURE: _____
TITLE: DATE:

Subscribed and sworn to me this ____ day of _____in the year of _____

NOTARY PUBLIC: SIGNATURE: _____
LOCATION:

My Commission Expires:

END OF DOCUMENT

SECTION 01 78 39
PROJECT RECORD DOCUMENTS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Definitions:
   1. Documents required for construction: Complete set of all documents required by Contract Documents, including but not limited to:
      a. Contract Drawings.
      b. Project Manual and Specifications.
      c. Addenda.
      d. Shop Drawings.
      e. Product Data.
      f. Samples and Mock-ups.
      g. Project Information.
      h. Change documents.
      i. Request for Information responses, directives, clarifications, interpretations, etc.
      j. Field test records.
      k. Warranties.
   2. Field documents: Complete set of all documents required for construction.
      a. Used for construction of project.
   3. Periodic Update Documents: Complete separate set of all documents required for construction, with exception of samples and mock-ups, used for posting and updating on weekly basis.
      a. Do not use for construction of project.
   4. Project Record Documents: Complete set of all documents required for construction, with exception of samples and mock-ups, for updating at end of Project.

1.2 SUBMITTALS

A. Contract closeout information:
   1. Copy of transmittal letter to Owner.
      a. At completion of project, turn over Project Record Documents to Owner with letter of transmittal.
      b. Submit Record Documents in suitable containers .
      c. Provide Transmittal Letter containing:
         1) Date.
         2) Project title.
         3) Contractor’s name and address.
         4) Title and number of each Project Record Document.
         5) Certification that Project Record Documents submitted are complete, accurate and reflect actual construction of project.
         6) Owner’s signature indicating receipt and acceptance of Project Record Documents.
   2. Copy of Record Drawing files on compact disk to Architect.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 POSTING PRIOR TO CONSTRUCTION

A. After Contract is executed, but prior to start of construction, obtain Contract Drawings and Project Manual/Specifications that will be used for Field Documents and Periodic Update Documents.

B. Obtain copies of all addenda and post to all above documents.

3.2 FIELD DOCUMENTS

A. Maintain minimum of one copy at project site.

B. Label each document “FIELD.”

C. Post documents with changes on a daily basis so they are up-to-date.

D. These documents are for construction of project.

3.3 PERIODIC UPDATE DOCUMENTS

A. Maintain one copy at project site.

B. Label each document “PERIODIC UPDATE.”

C. Do not use these documents for construction purposes.

D. Make documents available at all times for review by Architect, Owner and authorities having jurisdiction.

E. Maintain in clean, dry, legible condition.

F. Maintain Contract Drawings in stackable, enclosed cardboard file drawers designed to hold drawings horizontally.
   1. Provide index of contents of each file drawer on outside of drawer.

G. Maintain all other documents in stackable, enclosed file boxes designed to hold specific type of document.
   1. Provide index of contents of each box on outside of box.

3.4 POSTING AND UPDATING OF PERIODIC UPDATE DOCUMENTS

A. Post and update on weekly basis.

B. Contract drawings: Mark legibly to record actual construction including but not limited to:
   1. Depths of various elements of foundations in relation to first floor level.
   2. Horizontal and vertical location of underground utilities and appurtenances referenced to permanent surface improvements.
   3. Location of internal utilities and appurtenances concealed in construction referenced to visible and accessible features of structure.
   4. Field changes of dimension and detail.
   5. Changes made by change order, field order, clarifications, interpretations, directives, etc.
   6. Addenda.

C. Project Manual/Specifications: Type on each section to record all changes including but not limited to:
   1. Addenda.
   2. Change order or field order.
   3. Clarifications, interpretations, directives, etc.
   4. Bind added sections into Project Manual/Specifications.
   5. Indicate manufacturer, makes, and models used for actual construction of project.

D. Do not conceal work for which information must be recorded until all required information is recorded on Periodic Update Documents.
   1. Any work concealed prior to recording of required information must be uncovered.
   2. Once all required information is recorded on Periodic Update Documents, restore work at Contractor's expense.

E. Make available current fully posted set of Contract Documents to Owner's consultants including Authorities Having Jurisdiction, Special Inspections, and Testing Agencies.

3.5 PRODUCTION OF PROJECT RECORD DOCUMENTS

A. Record Drawings:
   1. Utilize set of Contract Drawings with Architect's seals and signatures removed shall be used for Record Drawings.
   2. Skilled draftsperson shall transfer all changes, corrections, entries, and other items from Periodic Update Documents to prints utilizing red pen.
   3. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent place.
   4. Scan Record Drawings into electronic PDF file format.
      a. 300 dpi resolution.
      b. Name each PDF file to match Contract Drawing identification (i.e. "A-103G.pdf").
   5. Provide Owner original Record Drawings, and CD-R of scanned drawings in PDF file format.
   6. Provide Architect CD-R of scanned drawings in PDF file format.

B. Record Computer Aided Drafting (CAD) System Drawings:
   1. Provide Record Drawings plan sheets in electronic CAD format for systems indicated in Submittal Procedures section (see Division 1).
      a. Record Drawings shall be in same CAD program and version as indicated in Submittal Procedures section (see Division 1).
      b. Have skilled CAD technician(s) update CAD files, which were developed for Coordination Drawings and Shop Drawings submittals, with information from Periodic Update Documents.
      c. All CAD work shall be compliant with National CAD Standards as published and represented as the most current version.
      d. Provide in same size and scale as original Contract Drawings.
      e. Organize CAD information into separate electronic files that correspond to each sheet of Contract Drawings.
         1) Name and number CAD drawing with corresponding information on Contract Drawing.
         2) Name each CAD drawing file with the drawing identification.
      f. Label each document "PROJECT RECORD PRODUCED BY CONTRACTOR" and date in prominent place.
      g. Redraw, delete or add details or both, and notations where applicable.
      h. Produce new CAD drawing(s) in lieu of updating original CAD drawing file where not suitable to indicate actual installation.
         1) New CAD drawing(s) will be required to be produced when a contract change document was issued as a result of acceptance of alternate, substitution or other modification.
      i. Architect will furnish Contractor with revised CAD drawing file(s) of architectural plan backgrounds if they were significantly revised by Architect during the construction phase.
         1) CAD drawings floor plan backgrounds will indicate wall layout, column lines and room name and numbering.
         2) Architect makes no representation as to accuracy or completeness of CAD files.
   2. Submit one (1) set of plots for review prior to submitting final CAD files.
   3. Submit two (2) copies of final updated CAD files on CD-R and one (1) set of plots.

a. Include all system drawing files, whether or not changes and additional information was on Periodic Update Documents.

4. Submit one (1) CD-R to Owner and one (1) CD-R to Architect of final Record Drawings files in PDF format electronically created from CAD files, not scanned.
   a. Include all system drawing files, whether or not changes and additional information was on Periodic Update Documents.

C. Other Record Documents:
   1. Periodic Update Documents may be used for Project Record Documents provided they are in satisfactory condition.
      a. Replace any Periodic Update Document found to be in unsatisfactory condition.
   2. Transfer all recorded changes from original to replacement copy.
   3. Label each document “PROJECT RECORD PRODUCED BY CONTRACTOR” and date in prominent place.

END OF SECTION

SECTION 01 78 43

SPARE PARTS, TOOLS AND MAINTENANCE MATERIALS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Contract Closeout Information:
   1. Submit spare parts, tools and materials directly to Owner.
   2. Submittal to Architect is not required.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Spare Parts and Tools:
   1. Package in clearly identified boxes.
   2. Indicate manufacturer's name, part name and stock number.
   3. Indicate piece of equipment part or tool is for.
   4. Indicate name, address and phone number of closest supplier.

B. Maintenance Materials:
   1. Package in clearly identified boxes.
   2. Indicate trade name and stock number.
   3. Indicate which item material is to be used with.
   4. Indicate name, address and phone number of closest supplier.

C. Extra Materials:
   1. Package in clearly identified containers, or install where indicated.
   2. Indicate trade name, stock number, size, color, etc.
   3. Indicate where product is to be used.
   4. Indicate name, address and phone number of closest supplier.

PART 3 - EXECUTION

3.1 DELIVERY

A. Deliver to Owner prior to substantial completion unless Owner requests earlier delivery.

B. Deliver to location directed by Owner.

C. Complete Maintenance Material Transmittal form at end of this Section.
   1. Acquire Owner's acceptance of items listed on transmittal.
   2. Transmittal to indicate Owner's acceptance.
   3. Forward copy of transmittal forms with Owner's acceptance to Architect.

END OF SECTION

SPARE PARTS, TOOLS AND MAINTENANCE MATERIAL TRANSMITTAL

Project:

To Owner: **Date:**

From C.M./Contractor:

Package extra material, maintenance materials, spare parts, and tools in clearly identified boxes; indicate manufacturer's name, trade name, part name, stock number, size, color, etc. Indicate which item maintenance material is to be used with, piece of equipment part or tool is for, or where extra material is to be used. Indicate name, address, and phone of closest supplier.

Owner's Verification and Acceptance

Accepted by: _____ **Date:** _____

Forward copy of this transmittal to the Architect.

DISTRIBUTION: ☐ OWNER ☐ CONTRACTOR ☐ C. M. ☐ ARCHITECT

END OF TRANSMITTAL

SECTION 01 79 00
SYSTEM DEMONSTRATIONS

PART 1 - GENERAL

1.1 DESCRIPTION

A. Provide instruction for all equipment and systems for which operating and maintenance data is required.

1.2 QUALITY ASSURANCE

A. Instructors:
   1. Member of installer's staff and authorized representative of component, assembly, or system manufacturer.
   2. See specification technical sections for additional requirements.

1.3 SUBMITTALS

A. Contract Closeout Information:
   1. Transmittal letter indicating Owner’s receipt of required demonstrations, copies of completed reports and video files.

1.4 JOB CONDITIONS

A. Complete all instruction prior to Substantial Completion.
   1. Submit separate report for each system or type of equipment, subject to Owner’s approval.
      a. Submit report (form attached), with preliminary information indicated, to Owner at least 2 weeks prior to first instruction period.
      b. Submit completed report to Owner and Architect.
   2. Submit video files for each instruction to Owner.
      a. Name each file with description of equipment or system.
      b. Provide index of instruction files.
      c. Provide on DVD.

PART 2 - EXECUTION

2.1 PREPARATION

A. Do not begin instruction until component, assembly, or system has been tested as specified and is in correct operating condition.

B. Assemble instructional aids.

C. Have operating and maintenance data available for use during instruction.

D. Have video equipment available for each instruction.

E. Schedule all instruction with Owner.

2.2 INSTRUCTION

A. Video all instructions.

B. Instruct Owner’s personnel in operation and maintenance of equipment and systems.

C. Provide all necessary instruction to satisfaction of Owner.

D. Explain use of operating and maintenance manuals.

E. Tour building areas involved and identify:
   1. Maintenance points and access.

2. Control locations and equipment.

F. Explain operating sequences.
   1. Identify location and show operation of switches, valves, etc., used to start, stop and adjust systems.
   2. Explain use of flow diagrams, operating sequence diagrams, etc.
   3. Demonstrate operation through complete cycle or cycles and full range of operation in all modes, including testing and adjusting relevant to operation.

G. Explain use of control equipment, including temperature settings, switch modes, available adjustments, reading of gauges, and functions that must be serviced only by authorized factory representatives.

H. Explain trouble shooting procedures.
   1. Demonstrate common occurring problems.
   2. Note procedures which must be performed by factory personnel.

I. Explain maintenance procedures and requirements.
   1. Point out items requiring periodic maintenance.
   2. Demonstrate typical preventive maintenance procedures and recommended typical maintenance intervals.
   3. Demonstrate other commonly occurring maintenance procedures not part of preventive maintenance program.
   4. Identify maintenance materials to be used.

J. Furnish all tools required.

END OF SECTION

EQUIPMENT AND SYSTEMS OWNER INSTRUCTION REPORT

Project: _____
Project No.: _____
Contractor: _____
System or equipment: _____
Specification Section: _____

NOTE: Contractor's Representative/Construction Managers Representative maintain and complete this report during course of instruction.

PRELIMINARY INFORMATION

To be completed by Contractor/Construction Manager:
Proposed dates for instruction period: _____ to _____.
Contractor Representative conducting instruction: _____.
Number of hours of instruction required by Contract Documents: _____.

To be completed by Owner:
Owner's personnel to be instructed (designate supervisor if required).
_____
_____

INSTRUCTION LOG						
Date	**No. Hours**	**Material Covered**	**Instr. Init.**	**Owner's Personnel Receiving Instruction**	**Init.**	**Comments**

Total Hours Completed: _____ Instructor's Signature: _____

Date Instruction Completed: _____ Owner's Signature: _____

Distribution: ❑ Owner ❑ Architect ❑ Construction Manager ❑ Contractor

END INSTRUCTION REPORT

SECTION 01 81 21

INDOOR AIR QUALITY MANAGEMENT (IAQ) DURING CONSTRUCTION

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements governing protection of indoor air quality (IAQ), absorbent materials, and mechanical system from contamination during construction and building flush out.

1.2 QUALITY ASSURANCE

A. SMACNA Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3).

1.3 DESCRIPTION - GENERAL

A. IAQ Management During Construction: Minimize contaminants generated during construction. Methods to include, but not limited to:
   1. Practices which minimize the amount of dust generated.
   2. Reduction of solvent fumes and volatile organic compound (VOC) emissions.
   3. Maintaining good housekeeping practices including sweeping and periodic dust and debris removal.
   4. Maintain dry conditions to protect stored on-site and installed absorptive materials from moisture damage.
   5. No visible haze in the air.

B. Prevent migration of moisture from exterior to building interior and prevent release of moisture from building materials that could result in formation of mold, delamination of adhesive applied materials or other damages caused by water.

1.4 PRECONSTRUCTION CONFERENCE

A. After award of Contract and prior to the commencement of the Work, schedule and conduct meeting with Owner and Architect to discuss the proposed IAQ Management Plan and to develop agreement relative to details of IAQ Management During Construction procedures.

1.5 SUBMITTALS

A. Project Information:
   1. Construction IAQ Management Plan.
   2. Compliance Photographs:
      a. Provide a minimum of six (6) photographs at three distinct phases of completion demonstrating compliance with standard or examples of remediation efforts to bring into compliance.
      b. Date and time stamp photographs and identify approach taken for each.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 CONSTRUCTION IAQ MANAGEMENT

A. Construction IAQ Management Plan:
   1. Meet or exceed SMACNA Guidelines for Occupied Buildings Under Construction, 2nd Edition 2007, ANSI/SMACNA 008-2008 (Chapter 3), and include following measures:
      a. HVAC Protection.

b. Source Control.
c. Pathway Interruption.
d. Housekeeping.
e. Scheduling.

2. Provide solid physical barriers to isolate areas of construction.
   a. Securely attach and seal at floor and structure above.
3. Schedule adequate time for product installation.
4. Maintain negative pressure in construction area.
5. Do not recirculate air prior to occupancy.
6. Seal return air ducts and use direct exhaust to outside.
7. Factory age sheet goods.
8. Comply with manufacturer's instructions for appropriate drying times.
9. Protect installed absorbent materials with recycled or recyclable materials.

B. HVAC Protection:
1. Protect air handling and distribution equipment, and air supply and return ducting during construction.
2. Adequately cover and protect exposed air inlets and outlets, openings, grilles, ducts, plenums, as required to prevent water, moisture, and other contaminant intrusion.
3. Apply protection immediately after installation of equipment and ducting.
4. Protect duct runs at end of each day's Work.
5. During dust producing activities, e.g. drywall installation and finishing, turn ventilation system off, and protect HVAC supply and return openings from dust infiltration.
   a. Provide temporary ventilation.
6. Provide temporary filtration media for permanently installed air handlers if used during construction,
   a. Provide minimum efficiency reporting value (MERV) of 8 at each return air grille, per ASHRAE Standard 52.2 - 1999.
   b. Replace filtration media immediately prior to occupancy.

C. Source Control:
1. Protect stored on-site or installed absorptive or porous materials such as batt insulation and drywall from exposure to moisture.
2. Do not use wet, damaged porous materials in the building. Materials with evidence of moisture damage, including stains, are not acceptable, including both stored and installed materials. Immediately remove them from the site and properly dispose.
3. Preconditioning:
   a. Prior to site delivery off-gas odorous products, or products with significant volatile organic compound (VOC) emissions, in dry, well ventilated space for 14 calendar days.
   b. Condition products, without containers and packaging, to maximize off-gassing of VOCs.
   c. Condition products in a ventilated warehouse or other building. Provide a temperature range of 60 degF minimum to 90 degF maximum continuously during ventilation period.
   d. Do not ventilate within limits of Work unless otherwise accepted by Architect.
   e. Comply with substitution requirements for consideration of other locations.
4. Take special care to prevent accumulation of moisture on installed materials and within packaging during delivery, storage, and handling to prevent development of molds and mildew, including materials with moisture stains.
5. Replace moldy materials with new, undamaged materials.
6. Provide ventilation, air circulation and air changes to dissipate excess humidity when present.

D. Pathway Interruption:
1. Seal openings within the designated work area.
2. Install exhaust ventilation equipment to maintain negative pressure differential between work area and adjacent areas of building.

3. Exhaust ventilation units to outside of building.

E. Housekeeping:
1. Provide temporary ventilation during construction to minimize accumulation of dust fumes, vapors, or gases in the building.
2. Continuously ventilate during and after installation of materials that emit VOCs until emissions dissipate:
   a. Period after installation shall be sufficient to dissipate odors and elevated levels of VOCs. Where no specific period is specified, ventilate for minimum of 72 HRS.
   b. Ventilate areas directly to outside.
   c. If continuous ventilation is not possible via building's HVAC system, ventilate via openings and temporary fans at no less than 3 air changes per hour.
3. Suppress dust with wetting agents or sweeping compounds.
4. Remove dust using a wet method.
5. Increase cleaning frequency when dust build-up is noted.
6. Remove spills or excess applications of solvent-containing products as soon as possible.
7. Remove accumulated water and keep work areas as dry as possible.
8. Keep and store volatile liquid containers closed when container is inside of building and not in use.

F. Scheduling:
1. Where odorous or high VOC-emitting products are applied on site, apply before installation of porous and fibrous materials. Where not possible, protect porous materials with polyethylene vapor retarders.
2. Insure wet applied interior finish materials, such as paints, adhesives, sealants, coatings, finishes, and spray-applied materials, such as structural fireproofing, are fully cured prior to installation of finish materials.
3. Install carpets and furnishings after interior finish materials have been applied and fully cured.
4. Provide adequate ventilation of packaged dry products prior to installation. Remove from packaging and ventilate in a secure, dry, well-ventilated space free from strong contaminant sources and residues.
5. Complete interior finish material installation no less than 14 days prior to Substantial Completion.

END OF SECTION

DIVISION 02

EXISTING CONDITIONS

SECTION 02 41 00
DEMOLITION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Demolition, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Conduct work in accordance with OSHA and EPA requirements.

B. National Fire Protection Association (NFPA):
   1. NFPA 241 Standards for Safeguarding Construction, Alteration, and Demolition Operations.

C. Use only firms or individual trades qualified to perform work required under this section.

1.3 DESCRIPTION

A. Work includes:
   1. Demolition of structures indicated.
   2. Removal of demolition debris.
   3. Protection of construction to remain, including:
      a. Utilities.
      b. Other items indicated.
   4. Salvage of items.
      a. Coordinate salvaged items with owner.

B. Condition of existing structures to be demolished:
   1. Owner assumes no responsibility for actual condition of structures to be demolished.
   2. Owner will maintain building conditions existing at time of inspection for bidding purposes insofar as practicable.

C. Standpipes:
   1. Demolish with building.
   2. Maintain in operable condition and available for use by fire department.
   3. Do not demolish more than one floor below floor being demolished.

1.4 JOB CONDITIONS

A. Perform preliminary investigations as required to ascertain extent of work.
   1. Conditions apparent by such investigation will not be allowed as cause for claims for extra costs.

B. Before start of work, obtain and pay for permits required by authorities having jurisdiction and notify interested utilities companies.

C. Obtain approval of authorities having jurisdiction for work which affects existing exitways, exit stairs, means of egress, or access to, or exit from areas.
   1. Review with and obtain approval of authorities for temporary construction which affects such areas.
   2. Obtain approval of fire authorities.

D. Separate, store and dispose of hazardous materials and toxic wastes in accordance with local and EPA regulations and additional criteria listed below:
   1. Disposal of fluorescent light tubes in open containers is not permitted.

2. Disposal of ballasts and other building elements containing PCBs in open containers is not permitted.
3. Disposal of building elements containing mercury in open containers is not permitted.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 POLLUTION CONTROLS

A. Clean adjacent structures and improvements of dust, dirt, and debris caused by demolition operations.

B. Return adjacent areas to condition existing prior to start of work.

3.2 ITEMS TO BE SALVAGED FOR OWNER

A. Remove salvage items at appropriate stage of demolition, but early enough to prevent damage to them by demolition operations:
   1. Coordinate with Owner items Owner wishes to save.

B. Remove salvage items as a unit:
   1. Clean, list, and tag for storage.
   2. Protect from damage.
   3. Salvage each item with auxiliary or associated equipment required for operation.
   4. Store in area designated by Owner.

3.3 ITEMS SALVAGED FOR CONTRACTOR

A. Items of salvage value to Contractor may be removed from structure as work progresses.

B. Transport salvaged items from site as they are removed.

C. Storage or sale of removed items not permitted on site.

3.4 ITEMS TO BE REMOVED FOR RE-INSTALLATION IN PROJECT

A. Remove items designated for re-use:
   1. Tag, protect from damage, store if required, and deliver to locations designated.
   2. Brace motors attached to flexible mountings until reinstallation.

3.5 GENERAL DEMOLITION PROCEDURES

A. Demolition of entire portions of structures:
   1. Demolish completely and remove from site.
   2. Use such methods as required to complete work within limitations of governing regulations.
   3. Coordinate with Owner and utility suppliers for shut-off of utilities serving each building.
   4. Disconnect and seal utilities before commencement of demolition.

B. Start and complete work as established by approved schedule.

C. Protect property to remain:
   1. Repair damage caused by demolition, at no cost to Owner.
   2. Conduct operations to prevent damage by falling debris or other cause to adjacent buildings, structures, and other facilities as well as persons.
   3. Provide interior and exterior shoring, bracing, or support to prevent movement, settlement or collapse of structures.

D. Conduct operations to insure minimum interference with roads, walks, entrances, exits, and other adjacent occupied facilities.
   1. Do not close or obstruct private drives, walks or other occupied or used facilities unless approved in writing.

2. Do not close or obstruct public thoroughfares or walks unless approved by authorities having jurisdiction.
3. Do not obstruct exits from existing facilities without approval of authorities having jurisdiction.
4. Provide alternate routes around closed or obstructed traffic ways.

E. Provide covered passageways where necessary to ensure safe passage of persons in or near areas of work.

F. Provide barricades and safety lights as required.

G. Maintain existing utilities that are indicated to remain.
1. Keep in service and protect against damage during demolition.
2. Do not interrupt existing utilities serving occupied or facilities in use, except as authorized by Owner.
3. Provide temporary services during interruptions to existing utilities, as acceptable to Owner.

H. Structural demolition:
1. Demolish concrete and masonry in small sections.
2. Perform removal to avoid excessive loads on supporting walls, floors or framing.

3.6 PROTECTION OF OCCUPIED FACILITIES TO REMAIN

A. Protect occupants from injury and discomfort.

B. Provide temporary dustproof partitions between demolition areas and occupied areas.
1. In public areas use clean, painted 1/2 IN thick plywood.
2. Utilize fire rated construction where required by Authorities Having Jurisdiction,.

C. Provide temporary weather protection and insulation to prevent damage to existing facilities and discomfort to persons in occupied areas.
1. Insulation value: R 19.

3.7 CLEAN-UP AND DISPOSAL OF DEMOLITION MATERIALS

A. Remove debris, rubbish, and materials resulting from demolition operations.
1. Remove and legally dispose of off site.
2. Do not burn materials on site.

B. Dispose of items and materials not designated for Owner salvage or reuse.
1. Promptly remove from site.
2. Do not store or sell Contractor salvaged items or materials on site.

C. Clean up other debris resulting from this work.

END OF SECTION

DIVISION 03

CONCRETE

SECTION 03 05 00
CONCRETE

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Concrete, as indicated, in accordance with provisions of Contract Documents.

B. Coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM designated specifications for material quality and test methods appear throughout this specification.

B. Standards for concrete work: Comply with applicable provisions of following latest editions of American Concrete Institute (ACI) publications except as otherwise indicated.
   1. ACI 301 Specifications for Structural Concrete.
   2. ACI 304R Guide for Measuring, Mixing, Transporting, and Placing Concrete.

C. Concrete Mixture Proportioning:
   1. Employ and pay for testing agency acceptable to Architect and Owner to perform materials evaluation, testing and design of concrete mixes.
   2. Certificates, signed by material producer and Contractor, may be submitted in lieu of material testing when approved by Architect.

D. Concrete Testing:
   1. Constrctor will employ a testing laboratory to perform routine testing and evaluation of concrete delivered to jobsite.
   2. Contractor to assist with related communication and temporary storage of test cylinders at jobsite.

1.3 DEFINITIONS

A. Lightweight Concrete:
   1. Concrete made with low density, lightweight aggregate ASTM C330 or mixture of lightweight and normal weight aggregate.
   2. Usually having a dry unit weight less than 115 PCF.

B. Patching Cement
   1. Single component, polymer-reinforced, high-strength cement-based patching and resurfacing mortar.

C. Exposed construction: Concrete surface seen by the public from eye level from walking surface in a public location after completion of building.

1.4 SUBMITTALS

A. Public location: Building areas routinely accessible to public and employees not responsible for maintenance.
   1. Storerooms, unfinished space and large mechanical rooms are considered public locations.
   2. Equipment closets, elevator and mechanical penthouses are not considered public space.

B. Shop Drawings:
   1. Reinforcing drawings showing sufficient detail to permit placement in the field without reference to Contract Drawings.

C. Product Data:
   1. Concrete Mix Designs for each proposed concrete mix.
      a. Proportions of materials.

b. Slump.
c. Air content.
d. 7-day and 28-day compression test results of trial mixes or standard deviation analysis of an established mix.

2. Source and certification or proof of quality and compatibility of admixtures for each of the constituents of the proposed concrete mixes.
   a. Cement.
   b. Aggregate including gradation.
   c. Water.
   d. Admixtures:
      1) Air Entraining Admixture.
      2) High-Range Water Reducer.
      3) Other.
3. Curing compound.
   a. Interior slabs: Include floor covering manufacturer's written approval for use.
4. Patching Cement
   a. Manufacturer's Technical Data sheet showing product meets intended use and MSDS.

D. Project Information:
1. Testing Agency qualifications.
2. Production sample test reports:
   a. Include same data as required for mix design reports.
3. Reports of Contractor-optional tests.
4. Test reports for in-place testing, if such testing is performed.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Portland Cement: ASTM C150, Type I or Type III.
1. Cement Color: Natural gray.

B. Aggregates:
1. General:
   a. Regard fine and coarse aggregates as separate ingredients.
   b. Each size of coarse aggregate, as well as combination of sizes when two or more are used, shall conform to grading requirements of applicable ASTM specifications.
2. Lightweight Concrete:
   a. Coated expanded clay, slate or shale produced by rotary kiln process, conforming to ASTM C330.

C. Potable Water:
1. Conforming to ASTM C 1602.

D. Admixtures:
1. General:
   a. Use only when specifically required or permitted by Contract Documents, otherwise must be approved by Architect.
   b. Prepare trial mixes and tests with job materials, including admixture, to demonstrate effect on strength and durability of hardened concrete.
2. Calcium chloride or admixtures containing more than 0.05 percent chloride ions are not permitted.
3. Air-entraining Admixtures: ASTM C260.
4. Mid-Range Water Reducer: ASTM C494, Type A.
5. High-Range Water Reducer: ASTM C494, Type F or G.
   a. Daracem – 100 or Adva Flow Series by Grace Construction Products.
   b. MasterRheobuild 1000 , MasterGlenium Series or PS 1466 by BASF Master Builders Solutions.
   c. Eucon 37 or Eucon SPJ by Euclid Chemical.

d. PSP-N, PSP-N2, PSP-R, and PSP-L by Procrete Industries. .

6. Water-reducing, Retarding, and Accelerating Admixtures: ASTM C494.
7. Supplementary Cementitious Materials (including Fly Ash):
   a. Fly ash – ASTM C618, Class C or Class F.
      1) Obtain, prepare and test samples in accordance with ASTM C311.
   b. Ground Granulated Blast-Furnace Slag: ASTM C989, Grade 100 or 120.

E. Curing Compounds:
1. Strippable Curing Compound:
   a. The compound shall conform to ASTM C309, VOC Compliant, 350 g/l.
      1) For use on slabs receiving subsequent applied finishes and where noted on drawings.
      2) Install in accordance with manufacturer's recommendation and supervision.
   b. Acceptable Manufacturers
      1) Kurez DR VOX or Kurez W VOX
      2) Horncure WB Horncure WB 30 by the Euclid Chemical Company.
2. Chemical Curing Compound
   a. Base:
      1) L&M Construction Chemicals.
   b. Optional:
      1) Dayton Superior.
      2) Euclid.
      3) Sonneborn.
      4) WR Meadows..

F. Reinforcing Materials:
1. Reinforcing bars: ASTM A615, Grade-60.
2. Welded wire reinforcing: Flat Sheets conforming to ASTM A185.

G. Patching Cement
1. Base:
   a. Duracrete from L&M Construction Chemicals.
2. Optional
   a. Sikatop 122 from Sika Corporation
   b. FlexSet from Roklin
3. Other manufacturers desiring approval comply with requirements of Section 00 26 00.

2.2 PROPORTIONING CONCRETE MIXES

A. General:
1. Contractor and concrete supplier are responsible to provide concrete, in-place, which satisfies requirements listed in following table.
2. Contractor and concrete supplier are responsible to adjust concrete mixes, as needed, to:
   a. Correct for non-conformance.
   b. Correct for a variation in the quality of a constituent.
   c. Compensate for extreme conditions in the field.

B. Establish concrete material proportions by proportioning methods described in ACI-301 guidelines.

Concrete Properties Table – IP Units

Use	28-day strength (KSI)	Dry Unit Weight (PCF)	Max Aggregate Size (IN)	Air %	Max. W/C Ratio	Slump (IN)	Cement type
Footings ,Grade Beams	3.5		1-1/2	4.5	0.60	4	I
Caissons	4.0		1 1/2		0.45	6	I

Concrete Properties Table – IP Units							
Use	**28-day strength (KSI)**	**Dry Unit Weight (PCF)**	**Max Aggregate Size (IN)**	**Air %**	**Max. W/C Ratio**	**Slump (IN)**	**Cement type**
Walls	4.0		1	4.5	0.50	5	I
Slabs-on-grade	3.5		1 1/2		0.45	3	I
Structural floors, girders, slabs, columns	4.0		3/4		0.45	9	I
Post-tensioned slabs & beams	5.0		3/4 or 1	6	0.40	9	I
Columns	6.0		3/4		0.35	9	I
Radiology Shield, Wall, and Roof	3.0	147	1		0.70	4	I
Lt. Wt. Slabs on composite metal deck	3.5	115	3/4		0.50	6	I
Norm. Wt. Slabs on composite metal deck	3.5		3/4		0.50	6	I
Lt. Wt. Slabs, beams, girders	4.0	112	3/4		0.45	6	I
All other uses	4.0		3/4	6	0.50	4	I

C. Instructions for use of Table:
   1. Provide concrete mixes with properties indicated in locations identified in Use column.
   2. 28-day Strength:
      a. Installed concrete must meet or exceed the minimum 28-day compressive strength indicated.
      b. Laboratory mix design strengths must exceed this strength by the appropriate amount per ACI-301.
      c. Determine strength in accordance with ASTM C192 and ASTM C39.
   3. Dry Unit Weight:
      a. If no value is listed, assume normal weight.
      b. Dry unit weight of light weight mixes shall be maximum air dry unit weight permitted.
      c. Correlate fresh weight with air dry of same mix to use as basis of acceptance on job site. Test in accordance with ASTM C567.
   4. Maximum Aggregate Size:
      a. Maximum size of coarse aggregate determined in accordance with:
         1) ASTM C33 for normal weight concrete.
         2) ASTM C330 for lightweight concrete.
      b. Some mixes are designated 3/4 IN or 1 IN, permitting contractor / supplier option.
   5. Air Content:
      a. Required percentage of air as measured by ASTM C231, ASTM C173, or ASTM C138 as appropriate.
      b. Tolerance of air content as delivered is plus or minus 1-1/2 percent for normal weight and plus or minus 2 percent for lightweight concrete.
   6. Water Reducer:
      a. Mid-range water-reducer or high-range-water-reducer shall be provided as necessary to achieve slump indicated.
      b. Contractor, as option, may elect to use water reducers in other mixes to improve workability or permit pumping.
   7. Maximum W/C Ratio:
      a. Maximum ratio of pounds of water allowed to pounds of cemetitous material used in the concrete mix.

8. Maximum Slump:
    a. Mixes without Water-Reducers:
        1) Slump tolerance: Up to 1 IN above maximum indicated is allowed, provided the average of 5 consecutive batches does not exceed the indicated amount by more than a 1/2 IN.
    b. Mixes with Water Reducers:
        1) Slump indicated is after dosing.
        2) Slump tolerance after dosing: +1-1/2 IN and -1 IN is permitted for each batch.
        3) Slump tolerance prior to dosing: +1/2 IN and -1 IN from design mix slump.
    c. Determine slump in accordance with ASTM C143.
    d. Where slump is not specified, provide concrete with slump in accordance with approved mix designs
9. Cement:
    a. Provide cement type indicated.
    b. Fly Ash or Ground Blast Furnace Slag is acceptable for partial replacement of cement.
        1) For each unit of cement removed, replace with two (2) units of Class F fly ash or one (1) unit of Class C fly ash.
        2) For each unit of cement that is removed, replace with one (1) unit of Ground Blast Furnace Slag
        3) Maximum amount of cement replaced shall not exceed that specified in table 4.2.2.9 of ACI 301.
        4) W/C Ratio shall be based on total cementitious material content.

D. Admixtures:
    1. Use admixtures in accordance with manufacturer's instructions.
    2. Use only approved admixtures.

PART 3 - EXECUTION

3.1 STORAGE OF MATERIALS

A. Store cement in weather tight buildings, bins, or silos which will exclude moisture and contaminants.

B. Arrange aggregate stockpiles and use in a manner to avoid excessive segregation and to prevent contamination with other materials or with other sizes of like aggregates.
    1. Perform test to determine conformance to requirements for cleanliness and grading on samples secured from aggregates at point of batching.
    2. Do not use frozen or partially frozen aggregates.

C. Allow sand to drain until it has reached relatively uniform moisture content before use.

D. Pre-dampen dry, lightweight aggregates to prevent excessive variations in moisture content. Stockpile predampened aggregates a minimum of 12 hours before use.

E. Store admixtures in manner to avoid contamination, evaporation, or damage.
    1. For those used in form of suspensions or non-stable solutions, provide agitating equipment to assure uniform distribution of ingredients.
    2. Protect liquid admixtures from freezing and temperature changes which would adversely affect their characteristics.

3.2 MIXING AND DELIVERY

A. Batch, mix and transport concrete in accordance with ASTM C94/C94M.

B. Batch and mix admixtures in accordance with manufacturer's instructions. If two or more admixtures are used, verify compatibility with manufacturers

C. When adding water at job site is planned, deliver concrete to job site with a slump of 2 to 4 IN.
    1. Limit water additions at job site to comply with W/C Ratio requirements.

D. Following addition of high range water reducer, mix for a minimum of 70 revolutions or 5 minutes to assure a consistent mixture.

E. Reduction of required average strength:
   1. During construction, and after sufficient data becomes available, laboratory strength of mixes may be reduced in accordance with Section 4.2.3.6a of ACI-301, subject to approval by the Architect.

3.3 REINFORCEMENT

A. Accurately position, support and secure reinforcement and other cast-in items against displacement when placing concrete.

B. Locate and support with chairs, runners, spacers and hangers, as required.

C. Set wire ties so ends are directed into concrete.

D. Install welded wire reinforcement in maximum practicable sizes.

E. Lap sides and ends at least one mesh square plus 2 IN.

F. Place construction joints so as to not impair strength and appearance of structure in locations approved by Architect.

G. Set and build in anchorage devices and other embedded items required for other work that is attached to, or supported by concrete.

H. Place sleeves, inserts, anchors, and embedded items required for adjoining work or for its support, prior to concreting.

3.4 PLACING CONCRETE

A. Place concrete in compliance with recommendations of ACI 304.

B. Place in a continuous operation within planned joints or sections.

C. Begin placement when work of other trades affecting concrete is completed.

D. Consolidate concrete using mechanical vibrators supplemented with hand rodding and tamping, so that concrete is worked around reinforcement and embedded items into parts of forms.

E. Place patching cement in accordance with manufacturer’s instructions.

3.5 CURING

A. Begin curing as soon as free water has disappeared from exposed surfaces.

B. Keep moist for 72 hours.

C. Continue curing by use of moisture retaining cover or strippable membrane forming curing compound for a period of 14 days.

D. Cure formed surfaces by moist curing until forms are removed.

E. Provide protection as required to prevent damage to concrete.

3.6 PATCHING AND FINISHING

A. Slab trowel finish:
   1. Apply steel trowel finish to monolithic slab surfaces exposed to view or covered with resilient flooring or other thin film coating.
   2. Consolidate concrete surface by troweling, free of trowel marks, uniform in texture and appearance.
   3. Thoroughly consolidate surface by hand troweling.
   4. Leave finished surface essentially free of trowel marks, uniform in texture and appearance and plane to an Ff25/Fl20 tolerance.

END OF SECTION

DIVISION 04

MASONRY

SECTION 04 05 10
MASONRY CLEANING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Masonry Cleaning in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Project Information:
   1. Name of proposed product and manufacturer.
   2. Certification that the proposed products are compatible with materials on subject project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cleaners:
   1. Base:
      a. ProSoCo.
   2. Optional:
      a. EaCo Chem.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
   1. Use only products which are recommended by manufacturer of material to be cleaned.

B. Concrete Masonry (CMU) Cleaners:
   1. Clean CMU which will remain exposed to view (including CMU walls which are scheduled for painting).
   2. Lightweight and Normal Weight CMU:
      a. Base Product: Sure Klean Custom Masonry Cleaner by ProSoCo.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to be cleaned.
   1. If necessary point with mortar.

B. Waiting Time before cleaning:
   1. Mortar Types M and S: Allow mortar to cure for 7 to 14 days prior to cleaning.

C. Remove excess mortar using wooden paddles and scrapers.

D. Do not proceed with cleaning until unsatisfactory conditions have been corrected.

E. Test 4 x 4 FT area of each surface type for compatibility with cleaner, using recommended dilutions, prior to full scale cleaning operations.

F. Cleaning indicates acceptance of surfaces and responsibility for performance.

3.2 PREPARATION

A. Protect adjacent surfaces, not scheduled for cleaning.

B. Prepare surfaces as recommended by manufacturer.

3.3 CLEANING

A. Clean surfaces as recommended by manufacturer.

B. Do not use wire brushes.

C. Thoroughly rinse and pre-soak walls.

D. Flush loose mortar and dirt from surface.

E. Wet to prevent runoff streaking.

F. Apply solution using fibered wall washing brush or low-pressure spray.
   1. Maximum Pressure: not to exceed 400 PSI.
   2. Tip spray angle: Not less than 25 degrees.
   3. Maximum rate of flow: 4 to 6 GPM.
   4. Tip shall be held at least 12 IN from surface of masonry.
   5. Comply with manufacturer's recommendations, where more restrictive.

G. Scrape off mortar and re-apply cleaning solution.

H. After scrubbing, clean thoroughly with low pressure water.
   1. Comply with low-pressure spray criteria listed above.

END OF SECTION

SECTION 04 05 13

PORTLAND CEMENT-LIME (PCL) MORTARS & GROUT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Portland Cement-Lime (PCL) Mortars & Grout, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International:
1. ASTM C143 Standard Test Method for Slump of Hydraulic-Cement Concrete.
2. ASTM C144 Standard Specification for Aggregate for Masonry Mortar.
3. ASTM C150 Standard Specification for Portland Cement.
4. ASTM C207 Standard Specification for Hydrated Lime for Masonry Purposes.
5. ASTM C270 Specification for Unit Masonry.
6. ASTM C404 Standard Specification for Aggregates for Masonry Grout.
7. ASTM C476 Standard Specification for Grout for Masonry.

B. American Concrete Institute:
1. ACI 530.1 Building Code Requirements and Specification for Masonry Structures.

C. International Masonry Institute:
1. Technical Briefs.

D. Definitions:
1. PCL Mortar: Portland Cement-Lime Mortar.
2. PCL Grout: Portland Cement-Lime Grout.
3. Use of masonry cement alone, or in combination with and PCL mixes, is prohibited.
4. Pre-Blended: Factory blend mortar mix dry ingredients including; sand, cement, lime, pigments, etc.

1.3 SUBMITTALS

A. Product Data:
1. Material certificates for each material used in proposed mix designs.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Factory Pre-blended PCL Mortar:
1. Base:
   a. Spec Mix.
2. Optional:
   a. Amerimix (Bonsal).
   b. Quikrete.
   c. US Mix Company.

B. Site-Mixed PCL Grout:
1. Base:
   a. Products as indicated.

C. Integral Waterproofing Mortar admixture, for all locations:
   1. Base:
      a. Sonneborn Building Products; Hydracide Powder.
   2. Optional:
      a. Master Builders; Rheomix 235.
      b. Laticrete 8510.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS – PCL MORTARS

A. Factory Pre-blended Mortar Mix:
   1. Use approved mix designs which comply with ASTM C270, Property Method.
   2. Blend cementitious materials, aggregate and admixtures in factory under controlled conditions, which requires only addition of water at project site.
   3. Oven-dry aggregates prior to measuring and include in pre-blended mix.

B. Portland Cement: ASTM C150, Type I, II or III.
   1. Air-entraining cement is not permitted.
   2. Portland Cement Color: As indicated below for each application.
   3. Maximum percent of alkalis: 0.60.

C. Hydrated lime: ASTM C207, Type S.

D. Mortar aggregate:
   1. ASTM C144.
   2. Aggregate Color: As indicated below for each application.

E. Water: Potable.

F. Do not use the following ingredients:
   1. Do not use antifreeze additives.
   2. Do not use calcium chloride, thiocyanates, or other materials containing chloride ions.
   3. Other admixtures: Not permitted without prior approval by Architect.
   4. Do not use ready mix mortar.
   5. Do not use masonry cement.

2.3 SCHEDULE OF MORTAR TYPES

A. PCL mortar mixes to comply with ASTM C270, property specification using component materials listed above:
   1. Limit air content to 10 percent, maximum.
   2. Use appropriate type as indicated by following Table 4110A, for each condition.

TABLE 4110A - Basic Mortar Type Selection

Location(s)	Building Segment	Mortar Type per ASTM C270
INTERIOR MASONRY	Load bearing brick/block walls Non-load bearing brick/block walls	**N**

2.4 SCHEDULE OF MORTAR COLORS

A. Use the following mortar colors in conjunction with Table 4110A to determine mixes of appropriate combinations of type and color for each project condition.

B. Mortar Color MC-1:
   1. Location used:
      a. Typical at all locations.

2. Method:
   a. Factory pre-blended mortar.
3. Mortar Color:
   a. Natural Grey (no pigment).
4. Portland Cement Color:
   a. Natural.
5. Aggregate Color:
   a. Natural.

2.5 MATERIALS – PCL GROUT

A. Site-mixed PCL Grout:
1. Use approved mix designs.
2. Mix on-site using approved materials as indicated.
3. Factory pre-blended dry grout mixes may be used at contractor's option.
4. Ready-mixed product, delivered to site for direct placement in walls, may be used at contractor's option.

B. PCL Grout Mixes – General:
1. Comply with ASTM C476.
2. Portland Cement: ASTM C150, Type I, II or III.
   a. Air-entraining cement is not permitted.
   b. Maximum percent of alkalis: 0.60.
   c. Not permitted: blended hydraulic cements including portland blast-furnace slag cement, Portland-pozzolan cement, slag cement, and natural cement.
3. Grout aggregate: ASTM C404.
   a. Maximum Aggregate Size: 3/8 IN.
   b. The use of blast furnace slag is not permitted.
4. Hydrated lime:
   a. ASTM C207, Type S.
5. Water: Clean and potable.
6. Other admixtures: Not permitted without prior approval by Architect.
7. Compressive Strength: As indicated by GROUT MIX SCHEDULE, below, for each type.
8. Slump for Grout Measured in accordance with ASTM C143:
   a. Minimum: 8 IN.
   b. Maximum: 10 IN.

2.6 PCL GROUT MIX SCHEDULE

A. Grout Mix GM-1:
1. Site mixed grout.
   a. Redi-mixed or factory pre-blended may be used at contractor's option.
2. Compressive Strength, 28-day:
   a. Minimum 2000 PSI.
3. Location used:
   a. Fill for CMU walls.
   b. Hollow metal door frames.
   c. Elevator frames and sills.
   d. Other indicated locations.
4. Grout color: Natural grey, no pigment.
5. Portland cement color: Natural.
6. Aggregate color: Natural.
7. Grout mixtures shall not contain gypsum.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

3.2 MORTAR INSTALLATION

A. Mix materials minimum of 5 minutes, but not more than 10 minutes.

B. Adjust consistency to satisfaction of mason subject to compliance with specified criteria.

C. Install in accordance with International Masonry Institute Standards.

D. Strike joints to create a uniformly concave final joint.

E. If mortar begins to stiffen, it may be re-tempered in accordance with ASTM C270, Subparagraph 7.4.

F. Use mortar within 2-1/2 hours of initial mixing.

G. Remove units which are disturbed after laying. Clean off original mortar and reset with fresh mortar.

3.3 GROUT INSTALLATION

A. Mix materials minimum of 5 minutes, but not more than 10 minutes.

B. Use grout within 1-1/2 hours after initial mixing.

C. Use coarse grout in spaces larger than 2 IN in both directions.

D. Use fine grout in spaces with least dimension is less than 2 IN.

E. Grout Installation – frames:
   1. Use fine grout for hollow metal door frames.
      a. Grout frames of elevator hoistway openings.
      b. Grout hollow metal door frames where the net opening is 4 FT and greater.

F. Grout installation – walls:
   1. See Section 04 22 00.

END OF SECTION

SECTION 04 05 23
MASONRY ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Masonry Accessories, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Design Responsibility:
   1. Assume responsibility for design, manufacturing and installation of steel joists and accessories:
      a. Load combinations as specified by the building code.
      b. Where special loads only are shown, combine with typical loads or capacities for adjacent joists.

B. Welding Standard: Perform welding in accordance with applicable provisions of AWS Structural Welding Code D1.1.

C. TMS 402/ACI 530/ASCE 5 – Building Code Requirements for Masonry Structures

D. ASTM International:
   1. ASTM A240 Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for General Applications.
   2. ASTM A580 Stainless Steel Wire.
   3. ASTM A641 Zinc–Coated (Galvanized) Carbon Steel Wire.
   4. ASTM A615 Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement.
   5. ASTM D226 Asphalt-Saturated Organic Felt Used in Roofing and Waterproofing.

1.3 SUBMITTALS

A. Samples:
   1. Provide samples of materials where specified.

B. Project Information:
   1. Manufacturer literature for products proposed for use.
   2. Engineering calculations anchors with special loading or connection requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Masonry Anchors:
   1. Adjustable Wall Ties.
   2. Base:
      a. Hohmann & Barnard, Inc.
   3. Optional:
      a. Wire-Bond
      b. Sandell Manufacturing Company, Inc.

B. Horizontal Reinforcing:
   1. Base:
      a. Hohmann & Barnard, Inc.
   2. Optional:
      a. Sandell Manufacturing Company, Inc.

b. Wire-Bond
c. Heckmann Building Products, Inc.

C. Pre-molded Control Joint Strips:
1. Provide at control joints in CMU walls:
2. Base:
a. Hohmann & Barnard, Inc.
3. Optional:
a. Williams Products, Inc.
b. Sandell Manufacturing Company, Inc.
c. Wire-Bond
d. Heckmann Building Products, Inc.

D. Galvanizing Repair Paint:
1. Base:
a. ZRC Worldwide
2. Optional:
a. Tnemec, Inc.

E. Compressible Filler:
1. Base:
a. Hohmann & Barnard, Inc.
2. Optional:
a. Sandell Manufacturing Company, Inc.

F. Loose Lintels: Specified in Section 05 50 10.

G. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

A. Structural movements of building structure:
1. Inter-story drift caused by wind or earthquake forces.
a. h/400 or 1/2 IN maximum for wind.
2. Live load deflection of the supporting members.
a. Live Load L/600 or 3/8 IN maximum.
b. Post Composite Super imposed Dead Load + Live Load L/500 or 1/2 IN maximum.
3. Load Transfer Limitations:
a. Building structural frame is designed for gravity loads of wall system to be transferred to frame, floor by floor.

B. Develop details defining method of fastening throughout system.

C. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of Contract Documents.

2.3 MASONRY VENEER ANCHORS – STEEL COLUMNS

A. Use following anchor devices where masonry veneers bypass steel columns.

B. Offset Strap Anchor:
1. Type 304 Stainless Steel.
2. Mechanically attach to steel column/beams.
3. Base Product: 359FH by Hohmann & Barnard, Inc.

C. Wire Ties:
1. Type 304 Stainless Steel.
2. Diameter: 3/16 IN.
3. Length: As required for conditions.
4. Base Product: Vee Byna-Tie by Hohmann & Barnard, Inc.

2.4 MASONRY WALL ANCHORS

A. Use the following type of anchor devices where terminal ends of masonry walls abut steel columns:
   1. Offset Strap anchor:
      a. Type 304 Stainless Steel.
      b. Mechanically attach to steel column.
      c. Base Product: 359FW by Hohmann & Barnard, Inc.
   2. Wire tie:
      a. Type 304 Stainless Steel.
      b. Width: As required for width of CMU.
      c. Length: 12 IN.
      d. Diameter: 3/16 IN.
      e. Base Product: 302W by Hohmann & Barnard, Inc.

B. Rigid Steel Anchors (where CMU walls intersect other CMU walls):
   1. 1/8 IN x 1 IN x 12 IN.
   2. Galvanized G90.
   3. Ends bent 90 degrees in opposing directions.
      a. Length of end prongs: 2 IN.

2.5 HORIZONTAL REINFORCING

A. Materials:
   1. In interior walls:
      a. Cold drawn steel wire, mill galvanized, Class 3.
   2. In walls surrounding wet areas with humidity over 70 percent:
         1) Type 304stainless steel.
      b. Cold drawn steel wire, ASTM A82, hot-dip galvanized, ASTM A153, Class B2.
   3. In exterior walls:
      a. Type 304 stainless steel.
         1) Hot-dip Galvanized: ASTM A153 Class B2.

B. Horizontal Reinforcing:
   1. Free standing, single-wythe CMU walls.
   2. Horizontal reinforcing composite:
      a. Width as required.
   3. Base Product: 220 Ladder Mesh by Hohmann & Barnard, Inc.

2.6 VERTICAL REINFORCING

A. Reinforcing Bars:
   1. Grade-60 carbon steel.
   2. Size: No. 4 bars minimum, or as indicated.
   3. Refer to Section 03 20 00, and Drawings.

2.7 MISCELLANEOUS ANCHORAGES

A. Include miscellaneous anchorages as required or indicated to secure stone, architectural precast concrete copings and sills and like components.

B. Type:
   1. As indicated.

C. Material: Same as indicated for veneer anchors above.

2.8 MISCELLANEOUS ITEMS

A. Bond Breaker Strips: Asphalt saturated felt, unperforated; Type 1.

B. Galvanizing Repair Paint:
   1. Zinc rich paint for re-galvanizing welds and abrasions in galvanized steel.
   2. Base Product: ZRC Galvilite by ZRC Worldwide.

3. Optional: Organic Zinc Coating 90-93 by Tnemec.

C. Compressible Filler:
1. Closed cell neoprene sponge.
2. Thickness: 1/4 IN.
3. Base Product: NS by Hohmann & Barnard, Inc.

PART 3 - EXECUTION

3.1 INSTALLATION – GENERAL

A. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of the contract documents.

3.2 INSTALLATION – MASONRY WALL ANCHORS

A. Anchor CMU walls to building structure and intersecting CMU walls.

B. Provide specialized anchors types where masonry walls abut concrete or steel structural elements including shear walls, columns, and spandrel beams.

C. Where bearing walls meet or intersect erect walls separately and anchor together with rigid steel anchors spaced not more than 24 IN apart vertically.
1. Embed end bends of anchors in cores of masonry units filled with mortar or grout.

D. Where non-bearing walls meet or intersect other walls, erect walls separately and anchor together with wire mesh ties spaced not more than 16 IN apart vertically.
1. Embed ties centered in mortar within joint.

E. Fill solid with mortar or grout masonry unit cells within vertical planes of anchors, or use solid masonry units above and below anchors.

3.3 INSTALLATION – REINFORCING

A. See Section 04 22 00.

3.4 INSTALLATION OF OTHER ITEMS

A. Cavity Protection Material:
1. Install per manufacturer's recommendations at ledge angles and bottom of wall.

B. Galvanizing Repair Paint:
1. Apply at welds of galvanized masonry accessories or where galvanic coating is missing or damaged.

END OF SECTION

SECTION 04 22 00
CONCRETE MASONRY (CMU)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Concrete Masonry (CMU), as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Test results performed to qualify materials and establish mix designs

B. Mock-up:
   1. Use materials and procedures accepted for the work.
   2. Minimum sample panel size is 4 FT square.
   3. Acceptable standard for the work is established by accepted sample panel.
   4. Retain sample panel at site until Work has been completed.
   5. Include a grouting demonstration panel if grouting operations planned exceed or vary from limitations set forth in ACI 530.1-05 - Section 3.5

1.3 SUBMITTALS

A. Product Data:
   1. Certification of level of fire-resistance provided by units used in Fire Rated walls.

PART 2 - PRODUCTS

2.1 GENERAL

A. Units to be used in Fire-Resistive wall assemblies:
   1. Where units are used in assemblies with Fire-Resistive Rating:
      a. Provide units with aggregate type, and equivalent thickness that yield fire-resistances indicated for each wall assemblies.
      b. Acceptable calculation methodologies for determining Equivalent Thickness:
         1) ASTM C140.
         2) NCMA TEK 7-1B.
         3) ACI 216.1 / TMS 0216.
      c. Units tested per ASTM E119 are also acceptable.
   2. Provide solid units, or grouted hollow units, under lintels.
   3. Provide matching concrete bricks as required.
   4. Do not use chipped, cracked, spalled units exposed in finish work.
   5. Provide reinforced concrete masonry lintels fabricated from precast or site cast load bearing masonry units, filled and reinforced as indicated.

2.2 CONCRETE MASONRY UNITS - GENERAL PURPOSE

A. Concrete Masonry Units (CMU):
   1. Modular units complying with ASTM C90.
   2. Aggregate:
      a. Normal Weight: In accordance with ASTM C33.
   3. Sizes and shapes as indicated or required for conditions.
   4. Face shell and web thickness: Table 3, ASTM C90.

B. Corner Units:
   1. Exposed to view: Use bullnose units at external corners and jambs of openings.
   2. Not Exposed to view: Square-nosed units may be used where corners will not be visible in completed wall.

2.3 CONCRETE LINTELS AND SILLS

A. General:
   1. Fabricate concrete lintels and sills in plant or site cast.
   2. Use concrete having minimum 28 day compressive strength of 3000 PSI.
   3. Exposed surfaces to have surface texture and color to match adjacent concrete masonry units.
   4. Fabricate lintels to modular sizes to match coursing.
   5. Mark tops of lintels with lintel schedule number.

B. Fabricate lintels by one of following methods:
   1. Use masonry lintel units and reinforced concrete fill.
   2. Cast lintels monolithically with reinforcement.
   3. Provide vertical dummy joints matching pattern of vertical joints and scoring in concrete masonry walls in which installed.

2.4 REINFORCING

A. Horizontal Reinforcing products including wire ladder truss: Specified in Section 04 05 23.

B. Reinforcing Bars (vertical and horizontal): Specified in Section 03 20 00.

2.5 ACCESSORY ITEMS

A. Masonry Accessories: See Section 04 05 23.

B. Mortar and Grout: See Section 04 05 13.

C. Firestopping: See Section 07 84 00 for rated wall penetrations.

D. Sealants: See Section 07 92 16 for non-rated wall penetrations.

E. Grout Fill: See Section 04 05 13.

F. Concrete Fill:
   1. Minimum compressive strength, 3000 PSI.
   2. Maximum size of coarse aggregate, 3/8 IN.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept work.

B. Verify that anchors and flashings are correct.

C. Installation constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION

A. General:
   1. Comply with provisions of ACI 530 and ACI 530.1, except where exceeded by requirements of Contract Documents.
   2. Perform cutting with masonry saws.
   3. Cut as required to provide pattern indicated.
   4. Use solid units where cutting or laying would expose holes.
   5. Do not install damaged units.

6. Do not wet concrete masonry units.
7. Avoid use of less than half size units.
8. Build chases and recesses as indicated and required for work of other trades.

B. Install in running bond unless otherwise indicated.

3.3 FIRE AND SMOKE WALL IDENTIFICATION

A. Identify walls indicated on Drawings as having a required fire or smoke rating.
   1. Follow guidelines set in Chapter 7 of International Building Code.
   2. Permanently identify rating and type of barrier with stencil and paint in contrasting, 3 IN high letters in a manner acceptable to authority having jurisdiction.
   3. Text for fire and smoke barriers: “X HOUR FIRE AND/OR SMOKE BARRIER - PROTECT ALL OPENINGS”.

3.4 LAYING AND TOOLING

A. Lay out walls in advance for uniform and accurate spacing of bond patterns and joints.

B. Properly locate openings, movement joints and offsets.

C. Lay masonry units with face shells of bed joints fully mortared.
   1. Mortar webs in courses of piers, columns, and pilasters, in starting course on foundations and when necessary to confine grout or loose filled insulation.
   2. Mortar head joints a minimum distance from each face equal to face shell thickness.
   3. Align vertical cells and maintain openings unobstructed to be grouted.

D. Maintain nominal 3/8 IN joint widths.
   1. Cut joints flush where concealed.
   2. Tool exposed joints.
   3. Compress mortar in below ground joints.

E. Enlarge voids or holes, except weep holes, and fill with mortar during tooling.

F. Point up joints at corners, openings and adjacent work to provide neat, uniform appearance.

G. Remove masonry disturbed after laying.
   1. Clean and relay in fresh mortar.
   2. Do not pound units to fit.
   3. If adjustments are required, remove units, clean, and reset in fresh mortar.

H. Where work is stopped and later resumed, rake back 1/2 masonry unit length in each course; do not tooth.
   1. Remove loose units and mortar prior to laying fresh masonry.

I. Protect against weather, when work is not in progress.
   1. Cover top of walls with waterproof membrane, extend at least 4 FT down both sides of walls; anchor in place.
   2. Provide cold weather protection; Section 04 05 05.

J. Build in items indicated and specified.
   1. Fill with mortar around built-in items.
   2. Grout fill space between metal frames and masonry.
   3. Where built-in items are to be embedded in cores of hollow masonry units, place layer of metal lath in joint below and fill core with grout.

K. Remove masonry protrusions extending 1/2 IN or more into cells or cavities to be grouted.

3.5 REINFORCING

A. General:
   1. In addition to the following general requirements, provide reinforcing size type and spacing as indicated on Drawings and Details.

B. General Reinforcing Requirements:
   1. Reinforce masonry openings over 12 IN wide, where control and expansion joints are not provided, with horizontal joint reinforcing placed in 2 horizontal joints above lintel and below sill.
      a. Extend reinforcing minimum of 24 IN beyond jambs of opening.
   2. Embed horizontal reinforcing in bed joint mortar for entire length with minimum cover of 5/8 IN on exterior side of walls and 1/2 IN at other locations.
      a. Provide same minimum cover for other embedded items.
   3. Minimum laps for horizontal reinforcing: 6 IN.
   4. Do not bridge Control Joints or Expansion Joints with horizontal reinforcing.
      a. Install smooth dowels or other approved device across Control Joints which resist shear loads but allow in-plane expansion, contraction and linear shrinkage movements.

C. Horizontal Reinforcing (wire ladders/trusses):
   1. Provide continuous horizontal joint reinforcing concrete masonry walls.
      a. See elsewhere for reinforcing requirements for anchored veneers.
   2. Unless otherwise indicated:
      a. Install horizontal reinforcing with in 8 IN of first bed joint.
      b. Running Bonds: Install horizontal reinforcing at 16 IN OC vertically thereafter.
      c. Stacked Bonds: Install reinforcing 8 IN OC vertically thereafter where stack bond masonry is indicated.
   3. Make corners and wall intersections by use of prefabricated L and T sections.
      a. Cut and bend as required.
   4. At intersecting load bearing walls install rigid steel anchors not over 24 IN OC vertically.
      a. Embed ends in grout filled cores.

D. Horizontal Reinforcing Bars:
   1. Install where indicated.
   2. Sizes as indicated.

E. Vertical Reinforcing Bars at CMU Walls other than Anchored Veneers:
   1. Install vertical reinforcing bars as indicated.
   2. When not indicated, provide the following minimum vertical reinforcing:
      a. Provide one No.5 continuous at 48 IN on center.
      b. Provide one No.5 Continuous at each corner, at each side of each opening, at each side of each control joint, and at the ends of walls.

3.6 GROUT FILL

A. Do not place grout until entire portion of wall to be grouted has attained strength to resist grout pressure.

B. Use mechanical means to remove air pockets and voids for to consolidate fill.

C. Grout walls incrementally as CMU is placed.

D. Minimize lift heights to ensure walls remain safe and stable until grout has attained strength to resist overturning or collapse.
   1. Consider detrimental lateral loads which could be anticipated including storms, winds, seismic and soil conditions.
   2. Adequately brace.

E. Where vertical or horizontal reinforcing bars are required, place and inspect prior to filling operation.

F. Fill cores containing vertical reinforcing.

G. Place in maximum 4 FT lifts.

H. Leave lifts minimum 1-1/2 IN below top of course to form key with next lift.

3.7 CONTROL JOINTS (CJ)

A. Provide control joints and other movement joints as indicated.

B. Where not indicated:
   1. Locate control joints at natural planes of weakness in masonry wall such as:
      a. Changes in wall height.
      b. Changes in wall thickness, such as at pipe and duct chases and pilasters.
      c. At (above) movement joints in foundations and floors on which wall is bearing.
      d. At (above) movement joints in roofs and floors that bear on wall.
      e. Within 8 IN of one or both jambs of door, window, louver and similar openings:
         1) Place CJ at one side of openings less than 6 FT wide.
         2) Place CJ at both sides of openings greater than 6 FT wide.
      f. Within 4 FT of corners on one leg, minimum.
         1) Opposing leg: No more than 20 FT from corner.
      g. Intersections: Within 12 FT of wall intersections.
   2. In addition to of above, locate control joints at no more than the following absolute maximum (horizontal) distances:
      a. Walls less than 16 FT - 8 IN tall: Not more than 1-1/2 times wall height.
      b. Walls greater than 16 FT-8 IN tall: No more than 25 FT O.C.

C. Installation/construction of control joints:
   1. Utilize sash blocks or similar shapes which have slotted end to accept gaskets.
      a. Pre-molded Control Joint Strips: Specified in Section 04 05 23.
   2. Cut ladder/truss type horizontal reinforcing as it crosses control joints.
   3. While mortar is still fresh, rake out mortar from joint, leaving a completely clean joint.
   4. After wall has cured, install backer rod and sealant on both wall faces.
      a. Sealant and Backer Rod: Specified in Section 07 92 13 and Section 07 92 16.

3.8 INSTALLATION TOLERANCES

A. Maximum variation from plumb in vertical lines and surfaces of columns, walls and arises:
   1. 1/4 IN in 10 FT.
   2. 3/8 IN in a story height not over 20 FT.
   3. 1/2 IN in 40 FT or more.

B. Maximum variation from plumb for external corners, control joints, expansion joints and other conspicuous lines:
   1. 1/4 IN in any story or 20 FT maximum.
   2. 1/2 IN in FT or more.

C. Maximum variation from level of grades for exposed lintels, sills, horizontal grooves and other conspicuous lines:
   1. 1/4 IN in any bay or 20 FT.
   2. 1/2 IN in 40 FT or more.

D. Maximum variation from plan location of related portions of columns, walls and partitions:
   1. 1/2 IN in any bay or 20 FT.
   2. 3/4 IN in 40 FT or more.

E. Maximum variation in cross section of columns and thicknesses of walls from dimensions indicated:
   1. Minus 1/4 IN.
   2. Plus 1/2 IN.

3.9 REPAIR, POINTING AND CLEANING

A. Remove and replace loose, stained, or damaged units.
   1. Provide new units to match.
   2. Install in fresh mortar.

3. Point to eliminate evidence of replacement.

B. Clean in accordance with Section 04 05 10.

3.10 INSPECTION AND TESTING

A. Comply with the requirements of ACI 530.1 Section 1.6C and facilitate the testing and inspection agencies needs.

B. The Owner will provide testing and inspection services. This does not relieve the contractor of the responsibility to furnish materials and construction in full compliance of contract documents.

END OF SECTION

DIVISION 05

METALS

SECTION 05 05 05
GALVANIC CORROSION PROTECTION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Galvanic Corrosion Protection, as indicated, in accordance with provisions of Contract Documents.

B. Use information in this Section to coordinate, select and apply products listed in other Sections for purposes of Galvanic Corrosion Protection.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM STP576 Galvanic and Pitting Corrosion - Field and Laboratory Studies
   2. ASTM G82 Standard Guide for Development and Use of a Galvanic Series for Predicting Galvanic Corrosion Performance

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   1. Architectural Sheet Metal Manual – Appendix C

1.3 GALVANIC CORROSION POTENTIAL

A. Galvanic Scale: Less Noble, electropositive or anodic metals which corrode more readily are at top of scale. Those that are more electronegative or cathodic, Noble, are at bottom of scale.

GALVANIC SCALE
Anodic / Corroded End / Less Noble Materials
Zinc
Aluminum
Galvanized Steel
Cadmium
Mild Steel / Wrought Iron
Cast Iron
Stainless Steel, Types 304 & 316 (active)
Lead-tin Solder
Lead
Brass / Bronze
Copper
Stainless Steel, Types 304 & 316 (Passive)
Cathodic / Protected End / Noble Materials

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 INSTALLATION

A. Avoid contact between metals that are farther apart on the scale.

B. Do not couple a small exposed area of a less noble material with a large area of a more noble material.

C. Coat noble metal with a suitable paint or other non-metallic coating or coat both surfaces at interface with zinc chromate or bituminous coating.

D. Separate metals by tape, gasket, waterproof paper, elastomeric sheet, sealant or other non-absorptive, non-conductive material.

E. Do not allow moisture run-off from noble material to drain onto less noble material.

F. Do not use copper nails for fastening galvanized steel roof panels.

G. Do not use galvanized steel nails on copper roofing.

H. Do not use galvanized bolts, nuts or washers on stainless steel components.

3.2 METALS EMBEDDED IN CONCRETE

A. Hot-dip galvanized with bituminous paint.
   1. Use at exterior and interior areas exposed to weather or high humidity.

B. Non-galvanized steel with bituminous paint:
   1. Use at interior areas with low or ordinary humidity.
   2. Avoid direct embedment where exposed to weather or high humidity.

END OF SECTION

SECTION 05 12 00
STRUCTURAL STEEL

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Structural Steel, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Standards:
   1. American Institute of Steel Construction (AISC) Specifications for Design, Fabrication, and Erection of Structural Steel for Buildings and Commentary.
   2. American Welding Society (AWS) Structural Welding Code.

B. Field verify dimensions before fabricating steel.

1.3 SUBMITTALS

A. Shop drawings:
   1. Show shop and erection details including cuts, copes, connections, holes and welds.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Steel: ASTM A36, A992, A500-Grade B.

B. Bolts: ASTM A325.

2.2 SHOP PRIMING

A. Prime Paint:
   1. Comply with SJI and AISC, except asphalt type paint is not acceptable.
   2. Shop coat of red lead or rust-inhibitive paint standard with manufacturer.
   3. Comply with SSPC-15.

PART 3 - EXECUTION

3.1 ERECTION

A. Erect structural steel in compliance with AISC Specifications.

B. Use erection equipment suitable and safe for workmen.

3.2 CLEAN

A. Touch-up prime paint after erection.

B. Clean field welds, bolted connections and abraded areas, and apply same type paint as used in shop.

END OF SECTION

SECTION 05 31 23
METAL ROOF DECKING-REPAIR EXISTING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Metal Roof Decking, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

C. This section is provided to repair existing 4- 1/2” existing roof deck due to abandoned openings and reinforce existing roof deck at new openings. Existing drawings call out” 4 ½” steel deck type D”. No other information is available.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. ASTM A1008 Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Solution Hardened, and Bake Hardenable

B. American Iron and Steel Institute (AISI):
   1. Specification for Design of Cold-Formed Steel Structural Members.

C. American Welding Society (AWS):
   1. ANSI/AWS D1.3 Structural Welding Code – Sheet Steel.

D. Steel Deck Institute (SDI):
   1. Steel Roof Decking Design Manual.

E. Qualify welding processes and operations in accordance with AWS Standard Qualification Procedure.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Complete layout indicating types of deck panels, anchorage, supplementary framing, cut openings, accessories, and thicknesses.

B. Product Data:
   1. Manufacturer’s load tables for deck to be furnished on this project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Base:
   1. ASC Steel Deck.
      a. Field verify ASC deck matches existing metal roof deck profile.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Metal roof decking:

1. Rib type, sheet steel, 20 GA minimum, with minimum uncoated thickness of 0.034 IN.
2. Fy= 33 KSI, Structural Steel.
3. 4-1/2 IN deep.
   a. Base: 4.5D-12 Deep Deck by ASC Steel Deck
4. Galvanized decking: ASTM A653, G60 zinc coating.

B. Welding rod: E-60XX or greater in accordance with AWS D1.3

C. Mechanical Fasteners:
   1. Corrosion-resistant, low-velocity fasteners.
      a. Powder actuated:
         1) Base:
            a) Hilti Inc., steel deck fastener.
      b. Pneumatically driven:
         1) Base:
            a) Pneutek, Inc.
      c. Self drilling, self threading screws:
         1) Hexagonal washer head; carbon-steel screws, No. 10 diameter min size.
         2) Base:
            a) Hilti, Inc
         3) Optional:
            a) Elco Textron
            b) Buildex
      d. Other manufacturers desiring approval comply with Section 00 26 00.

D. Steel shapes, miscellaneous: ASTM A36.

E. Galvanizing for metal accessories: ASTM A653, G60.

F. Galvanizing repair paint: High zinc dust content paint, Mil-P-21035 ships.

G. Metal closure strips: Galvanized sheet steel, minimum 0.034 IN thick before coating, ASTM A653, G60 galvanized. See Part 3 - Execution for locations.

2.3 FABRICATION

A. Form in lengths to span 3 or more support spacing, with flush, telescoped or nested 2 IN end laps.
   1. Use deck configurations complying with SDI Basic Design Specifications and as indicated.

B. Form metal closure strips to configuration required to provide tight-fitting closures at open ends and sides of decking.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine areas and conditions under which deck units are to be installed for conditions detrimental to proper and timely completion of work.

B. Do not proceed with work until unsatisfactory conditions have been corrected.

C. Start of installation constitutes acceptance of responsibility for correct installation and performance.

3.2 INSTALLATION

A. Do not overload supporting members.

B. Install roof deck units and accessories as indicated.

C. Do not start placement of roof deck units until supporting members are installed complete.

D. Place each deck unit on supporting structural frame, adjust to final position, accurately align with ends bearing on supporting members.
   1. Lap units at ends no less than 2 IN.
   2. Do not stretch or contract side-lap interlocks.
   3. Place deck units flat and square and secure to framing without warp or excessive deflection.
   4. Install deck ends over supporting frame with a minimum end bearing of 1-1/2 IN.

E. Remove and replace decking which is structurally weak or unsound or damaged due to existing deck penetraionts or which Architect declares defective.

F. Cut and fit roof units and accessories around other work projecting through or adjacent to roof decking or to patch existing roof openings that have been abandonded.
   1. Make cutting and fitting neat, square and trim.
   2. Neatly and accurately install reinforcing at openings except:
      a. Circular openings less than 6 IN diameter.
      b. Rectangular openings having no side dimension greater than 6 IN.
   3. Reinforce openings between 6 IN and 12 IN with 20 GA flat steel sheet 12 IN greater in each dimension than opening. Place sheet around opening and fusion weld to top surface of deck at each corner and each side midway between each corner.
   4. For roof openings larger than 12 IN and at roof drains: Support deck edges as indicated on Drawings

G. Install metal closure strips for support of roof insulation.
   1. Provide where rib openings in top surface of roof decking occur adjacent to edge and openings.

H. Install metal closure strips at open uncovered ends and edges of roof decking, and in voids between decking and other construction.
   1. Weld into position to provide a complete decking installation.

3.3 FASTENING OF ROOF DECKING

A. Mechanical connection requirements
   1. Mechanical fasteners, powder actuated or pneumatically driven steel pins, may be used in lieu of welding indicated to fasten deck to supports.
      a. Locate mechanical fasteners and install according to manufacturer's written instructions and as specified below.
      b. Pin size, spacing, and accessories:
         1) Pin diameter and length per manufacturer's instructions for numbers of layers, deck gage, and steel flange thickness at a given condition.
         2) Connect edge and interior ribs of deck units with a minimum of two pins per deck unit at each support.
            a) Space pins 18 IN apart, maximum.
            b) Space pins 12 IN apart in the field of roof and 6 IN apart in roof corners and perimeter, based on roof-area definitions in FMG Loss Prevention Data Sheet 1-28.
            c) Space pins as indicated.
         3) Install steel washers or provide pins with integral washers at each pin location. Washer size per manufacturer requirements.
   2. Side-Lap and Perimeter Edge Fastening:
      a. Fasten side laps and perimeter edges of panels between supports, at intervals not exceeding the lesser of 1/2 of the span or 18 IN, and as follows:
      b. Mechanically fasten with self-drilling, No. 10 diameter or larger, carbon-steel screws.
      c. Mechanically clinch or button punch.

3.4 CLEANING

A. Wire brush, clean and paint scarred areas, welds and rust spots on top surfaces of decking units and supporting steel members.

B. Touch-up damaged galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instructions.

C. Touch-up shop painted surfaces with same paint used in shop, as recommended by deck manufacturer.

END OF SECTION

SECTION 05 36 00
COMPOSITE METAL FORM DECK

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Composite Metal Form Deck, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. American Iron and Steel Institute (AISI):
   1. Specification for Design of Cold-Formed Steel Structural Members.

B. American Welding Society (AWS):
   1. ANSI/AWS D1.3 Structural Welding Code – Sheet Steel.

C. Steel Deck Institute (SDI):
   1. Steel Roof Decking Design Manual.

D. Qualify welding processes and welding operators in accordance with AWS qualification procedures.

E. Minimum Thickness:
   1. Where gage of metal is indicated, provide following minimum uncoated steel thickness, unless following performance requirements require greater thickness.

Gage	Minimum Thickness
20	0.034 IN
19	0.040 IN
18	0.045 IN
17	0.051 IN
16	0.057 IN

F. Performance Requirements:
   1. Provide form deck to act as bottom form for cast-in-place concrete slabs and which will become positive slab reinforcement through mechanical anchorage after concrete hardens.
   2. Provide deck thickness such that maximum deck stress shall not exceed 0.6 its yield strength under combined weights of wet concrete(including weight of additional concrete due to structural deflection), deck, and construction live loading of either 20 PSF uniform load or 150 LB concentrated load on a 1 FT wide section of deck.
   3. Provide deck with adequate thickness to limit maximum deflection relative to supporting structural members to 1/180 of clear span or 3/4 IN whichever is smaller, caused by combined weights of wet concrete and deck.
   4. Gage of deck furnished shall not be less than that indicated on the drawings.
   5. Configuration, physical and chemical properties and composite superimposed load carrying capacity of deck units furnished shall conform to manufacturer's catalog current at time bids are received.
   6. Provide accessories (pour stops, column closures, end closures, cover plates, and girder fillers) as needed to prevent concrete leakage.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Complete layout indicating types of deck panels, anchorage, supplementary framing, cut openings, accessories, deck thicknesses.
   2. Indicate areas requiring shoring on the shop drawings.

B. Product Data:
   1. Manufacturer's load tables for deck to be furnished on this project.

C. Product Information
   1. Manufacturers analysis of unshored span limits

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers and Designations:
   1. Composite metal form deck,2 IN:
      a. Base:
         1) Canam United Steel Deck; Type 3616 1-1/2 IN w/ flat metal pan .
            a) Acoustic and Non-Acoustic layouts shown on plan
         2) Verco Manufacturing; Type PLB –CD AC or BCD AC FORMLOK
            a) Acoustic and Non-Acoustic layouts shown on plan.
         3) Vulcraft; Type 1.5VVLP and 1.5VLPA
            a) Acoustic and Non-Acoustic layouts shown on plan.
   2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Composite Metal Form Deck:
   1. Cold formed from steel sheets, conforming to ASTM A653, Structural Quality, Grade-40 with G60 coating.

B. Accessories:
   1. Sheet steel closures, cover plates and other sheet steel accessories: Use same material and coating as for deck.

2.3 FABRICATION

A. Extend deck over three or more spans with butted end laps.

B. Form closures and cover plates to configuration required to form concrete and/or to prevent concrete leakage.

C. Locate end laps and accessories to maintain capacity of field applied studs for composite beams.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine areas and conditions under which deck units are to be installed for conditions detrimental to proper and timely completion of work.

B. Correct unsatisfactory conditions.

3.2 INSTALLATION

A. General:
   1. Do not overload supporting members.

2. Unless specifically noted otherwise, provide composite metal form deck for concrete slabs supported directly or indirectly by structural steel frame.
3. Install deck units and accessories in accordance with final shop drawings and as specified herein.
4. Do not start placing units before supporting members are completely installed in place.
5. Bear deck units on supporting members minimum of 2 IN. Butt units tightly together at centerline of support. Place abutting units in accurate and close alignment for entire length of run.
6. Neatly cut and fit deck units and accessories around columns, walls, and other objects projecting through or adjacent to deck. Install closures and cover plates as required to prevent concrete leakage.
7. Install shoring where indicated on shop drawings

B. Openings:
1. Deliver deck to job site intact when openings in deck are indicated on drawings to be installed after concrete fill is cured. Openings installed in this manner shall be paid for by trade requiring opening.
2. Where openings in floor are framed, deliver deck to job site cut to proper length.

C. Fastening – Welded Connectors:
1. For welding deck to supports, employ only welders, qualified under AWS qualification procedures, and experienced in welding light gauge metal.
2. Minimum deck fastening requirements:
   a. At end of each unit and at intermediate supports: Puddle welds at 12 IN on center with not less than two welds per support.
   b. At exterior beam parallel to deck span: Puddle welds or 1-1/4 IN seam welds at 24 IN on center.
   c. At male-female side laps, 1-1/2 IN long seam welds or button punching at 24 IN on center.
   d. At lapped side laps, -1/2 IN long seam welds at 24 IN on center.
   e. Sheet metal closures, cover plates: Self-drilling screws or tack welds at 24 IN on center.
3. Verify that minimum deck fastening requirements are adequate for safely supporting material and construction loads placed on deck from time of deck placement to time of concrete placement. Additional fastening required to accomplish this shall be provided and paid for by Contractor.
4. Puddle welds shall have effective fusion diameter not less than 1/2 IN. Weld metal shall penetrate layers of deck material at end laps and be thoroughly fused to supporting members.

END OF SECTION

SECTION 05 50 10
MISCELLANEOUS METAL FABRICATIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Miscellaneous Metal Fabrications, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International:
   1. ASTM A36 Standard Specification for Carbon Structural Steel
   2. ASTM A53 Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless
   3. ASTM A123 Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
   4. ASTM A307 Standard Specification for Carbon Steel Bolts, Studs, and Threaded Rod 60 000 PSI Tensile Strength
   5. ASTM A325 Standard Specification for Structural Bolts, Steel, Heat Treated, 120/105 ksi Minimum Tensile Strength
   6. ASTM A666 Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar
   7. ASTM A668 Standard Specification for Steel Forgings, Carbon and Alloy, for General Industrial Use
   8. ASTM A992 Standard Specification for Structural Steel Shapes
   9. ASTM B209 Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate
   10. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes

B. American Institute of Steel Construction (AISC)
   1. Steel Construction Manual

C. American Iron and Steel Institute (AISI):
   1. Specification for the Design of Cold-Formed Steel Structural Members.

D. American Welding Society (AWS):
   1. ANSI/AWS C1.1M/C1.1 Recommended Practices for Resistance Welding
   2. ANSI/AWS D1.1 Structural Welding Code - Steel.
   3. ANSI/AWS D1.3 Structural Welding Code - Sheet Steel.

E. National Association of Architectural Metals Manufacturers (NAAMM):
   1. Class 1, Architectural, per NAAMM AMP-555, Code of Standard Practice for the Architectural Industry.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Plans and elevations showing members and connections.
   2. Anchors and accessory items.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Materials Listed:
   1. Base: As noted.

B. Shop Primer:
   1. Base:
      a. As recommended by finish coat manufacturer for substrate.
   2. Optional:
      a. Sherwin-Williams.
      b. Tnemec.

C. Plank Grating
   1. Base:
      a. Cooper B-Line by Eaton
   2. Optional:
      a. McNichols

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Structural Steel:
   1. Steel, Structural W shapes and tee's: ASTM A992, 50KSI yield point.
   2. Other steel shapes and plate: ASTM A36.
   3. Pipe – Round ASTM A53 Grade B.
   4. Tubing square or rectangular: ASTM A500, grade-B, 46KSI minimum.

B. Steel Forgings:
   1. ASTM A668.

C. Bolts:
   1. ASTM A307, ASTM A325, ASTM A354.

D. Filler Metal:
   1. AWS Standards.

E. Aluminum:
   1. ASTM B308 for particular alloy in standard shapes and extrusions.
   2. ASTM B26 for castings.

F. Masonry Anchorage Devices:
   1. Standard manufactured items.
   2. Lead expansion shields for machine screws and bolts 1/4 IN and smaller: Head out embedded nut type.
   3. For machine screws and bolts larger than 1/4 IN: Manufacturers' standard.
   4. Bolt anchor expansion shields for lag bolts: Zinc alloy, long shield anchors.
   5. Bolt anchor expansion shields for bolts: Closed end bottom bearing type.
   6. Anchor to embed or set device in setting compound or epoxy grout where shown.

G. Fasteners:
   1. Galvanized or stainless where built into exterior walls.
   2. Select fasteners for type, grade and class required.
   3. Bolts and Nuts: Regular hexagon head ASTM A307, Grade-A.
   4. Lag Bolts: Square or octagonal head type.
   5. Machine Screws: Cadmium plated steel.
   6. Wood Screws: Flat head carbon steel.
   7. Plain Washers: Round, carbon steel.
   8. Lock Washers: Helical spring carbon steel.

H. Non-shrink Grout:
   1. Compressive strength: 9000 PSI at 7 days.
   2. Base Product: 1107 Advantage Grout by Dayton Superior.

I. Abrasive Warning Tape:
   1. Self-adhering, tape with slip resistive mineral surface.
   2. Color: Safety Yellow.
   3. Width: 2 IN, except where noted otherwise.
   4. Tape Type 2:
      a. Base Product: Safety-Walk 530 Conformable by 3M.
      b. Backing: Aluminum foil.
      c. Thickness: 0.035 IN.
      d. Use Type 2 at top and bottom rungs of ladders.

2.3 FABRICATION

A. Form to shapes indicated with straight lines, sharp angles, and smooth curves.

B. Shop fabricate in as large assemblies as practicable.

C. Anchorage Accessories:
   1. Items required securing wood to metal, wood to masonry, metals to masonry or concrete, metal to metal or metal to other items.

D. Drill or punch holes with smooth edges for temporary field connections and attachment of work by other trades.
   1. Conceal fastenings where practicable.

E. Make permanent shop and field connections with continuous fillet type welds.
   1. Grind exposed welds smooth.

F. Supply items required to complete construction and installation.

G. Meet requirements specified under Structural Steel for fabricating items of structural nature or use.

2.4 FINISHES

A. Items not to receive coatings:
   1. Surfaces scheduled to be fireproofed with spray-on material.
   2. Machined surfaces.
   3. Surfaces adjacent to field welds.
   4. Contact surfaces of bolt connections at slip connections.
   5. Top flanges of beams to receive shear connectors.
   6. Items for which no coating or field finish is specified.

B. Shop Primer for Interior Non-wet Items:
   1. Primer: Coordinate with field applied finish systems specified in Section 09 91 23.
   2. Apply primer for interior finish paint to following surfaces not receiving other coating:
      a. Surfaces exposed on interior.
   3. Clean thoroughly before priming; remove mill scale, rust, dirt, oil, and grease in accordance with SSPC-SP3.
   4. Apply in accordance with paint manufacturer's instructions.
      a. Apply minimum 0.002 IN, dry film thickness.

C. Finish Painting:
   1. Interior: See Section 09 91 23.

2.5 METAL FABRICATIONS

A. Ladders:
   1. Design to comply with the following regulations:
      a. ANSI-A14.3.

b. OSHA 29 1910.27.
2. Material:
a. Interior Ladders: Shop-primed steel, painted by Section 09 91 23.
3. Side rail members: Minimum 1/2 x 2 IN.
4. Rungs: Minimum 3/4 IN round or square bars.
5. Punch rungs through side rails and weld.
6. Size to support concentrated moving load of 200 LB.
7. Minimum clearance from centerline of rung to wall or obstruction: 7 IN.
8. Minimum ladder width: 16 IN between side rails.
9. Rung spacing: 12 IN O.C.
10. Apply abrasive warning tape Type 2 to top and bottom rung of ladders.

B. Plank Grating:
1. Complying with the following:
a. OSHA-Occupational Safety and Health Administration-Standards for walking-working surfaces. Part Number 1910, Subpart D
b. RR-G-1602D- Federal Specification For Safety Grating (other than bar type & excluding naval vessels)
2. Material and thickness (except were otherwise indicated):
a. Galvanized steel, nominal 1-1/2 IN TO 2 IN thick.
3. Load capacity: Support minimum uniform load of 200 PSF.
4. Provide hold down clips.
5. Serrated or slip resistant tops.
6. Furnish as planks 7 to 9-1/2" in width.

C. Steel Support Angles, Support Frames, and Loose Lintel Steel Members:
1. ASTM A36 steel, Sizes and configurations as indicated.
2. Items to be hot dip galvanized:
a. Items to be permanently exposed to weather, high-humidity, or wet conditions.
b. Items set into exterior walls.
3. Shop Prime interior items (in non-wet areas).

D. Miscellaneous Equipment Supports:
1. ASTM A36 steel, Sizes and configurations as indicated.
2. Examples of items included:
a. Supports for Coiling Doors and Grilles.
b. Ceiling hung toilet partitions.
c. Other miscellaneous support items as indicated.
3. Shop Prime interior items (in non-wet areas).

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

C. Verify wall backing has been installed for wall-mounted items specified in this Section.
1. See Section 09 22 16.

3.2 INSTALLATION

A. General:
1. Set work level, true to line, plumb.
2. Weld field connections and grind smooth.
3. Where practical, conceal fastenings.
4. Secure metal to wood with lag screws of adequate size with appropriate washers.

5. Secure metal to concrete with embedded anchors, setting compounds, caulking and sleeves, or setting grout.
   a. Use expansion bolts, toggle bolts, or screws for light duty service.
6. Meet structural requirements for erecting items of structural nature.
7. Do not field splice fabricated items unless size requires splicing.
8. Weld splices.
9. Provide fabricated items complete with attachment devices as required to install.

B. Galvanic Repair:
   1. After galvanized units have been erected and anchored apply galvanizing repair paint in accordance with manufacturer's recommendations.
   2. Surface preparation: Remove contaminates in accordance with SSPC SP-1.

END OF SECTION

DIVISION 06

WOOD, PLASTICS, AND COMPOSITES

SECTION 06 10 53
ROUGH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Rough Carpentry, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Drawings indicate type, arrangement, and location of items of rough carpentry.
   1. If variations from arrangement or profile indicated are required, notify Architect.
   2. Make such variations at no added expense to Owner.

B. Contractor is responsible for fitting to recesses, including trim pieces, fillers, and closures.

C. Lumber Grading Rules and Species:
   1. US Department of Commerce (DOC):
      a. PS 20 American Softwood Lumber Standard.
   2. Western Wood Products Association (WWPA).
   3. Southern Forest Products Association (SFPA).

D. Plywood Grading Rules and Recommendations:
   1. US Department of Commerce (DOC):
      a. Softwood plywood: PS1 Structural Plywood.
   2. American Plywood Association (APA).

E. Preservative and Fire Retardant Treatment Standards:
   1. American Wood Protection Association (AWPA):
      a. AWPA U1Treated Wood.
      b. AWPA P5 Standard for Waterborne Preservatives.
   2. Underwriters Laboratories (UL)
   3. ASTM International requirements:
      a. ASTM E84 Standard Test Method for Surface Burning Characteristics
      b. ASTM D2898 Standard Method of Accelerated Weathering of Fire Retardant Treated Wood for Fire Testing

F. Factory Marking:
   1. Identify type, grade, moisture content, inspection service, producing mill, and other qualities.
   2. Mark each piece of fire retardant treated material with Underwriters Laboratory Classification mark and fire-retardant treatment for identification.
   3. International Building Code (IBC):
      a. Requirements for identification and labeling.

1.3 SUBMITTALS

A. Project Information:
   1. Certification of fire retardant treated material.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fire-retardant Treated Dimension Lumber and Plywood:
   1. Base:
      a. Western Wood Preserving Company
      b. Hoover Treated Wood Products, Incorporated
   2. Optional:
      a. Arch Wood Protection, Incorporated

B. Preservative Treated Lumber:
   1. Base:
      a. Lonza Group Limited
   2. Optional:
      a. Arch Wood Protection Incorporated
      b. Stella-Jones Incorporated
      c. Western Wood Preserving Company

2.2 MATERIALS

A. Dimensional Lumber and Plywood:
   1. Thoroughly seasoned, non-treated, well-fabricated materials.
   2. Longest practical lengths and sizes.
   3. Application, except where treated types are indicated:
      a. Non-structural framing, blocking, backing, nailers, grounds, and similar members.
      b. Other locations where indicated.

B. Fire-retardant Treated Lumber and Plywood (FRT):
   1. Flame spread index: Less than 25.
   2. Smoke developed index: Less than 450.
   3. Free of halogens, sulfates, chlorides, arsenic, ammonium phosphate, formaldehyde, and urea formaldehyde.
   4. Kiln dried after treatment, (KDAT).
   5. FRT material for interior and above grade locations:
      a. Base: Pyro-Guard by Hoover Treated Wood Products, Incorporated
      b. Optional:
         1) Dricon FRT by Arch Wood Protection.
         2) FirePro by Western Wood Preserving Company.
      c. Natural wood products treated to add fire-retardant qualities.
      d. Moisture content: Not more than 28 percent.
      e. Interior and above grade applications include but not limited to:
         1) Interior, above grade framing, blocking, and sill plates within non-load bearing interior partitions that are fire rated 2 hours or less.
         2) Platforms and Stages.
         3) Wood in concealed spaces.
         4) Plywood backing panels for electrical, telecommunication equipment.
         5) Similar locations where wood products are indicated and building code does not permit non-fire-resistive treated products.

C. Adhesives for bonding furring, sleepers, sills and similar items to concrete or masonry:
   1. Approved for indicated use by adhesive manufacturer.
   2. Comply with ASTM D3498.

2.3 FASTENERS

A. General:
   1. Provide fasteners of size and type indicated that comply with requirements specified for material and manufacture.
   2. Where rough carpentry is exposed to weather, in contact with earth, pressure-preservative treated, or in area of high relative humidity:
      a. Use fasteners with hot dip zinc coating complying with ASTM A153.
      b. Use fasteners of Type 304 stainless steel.

B. Nails, Brads, and Staples: ASTM F1667.

C. Power-Driven Fasteners: NES NER-272.

D. Wood Screws: ASME B18.6.1.

E. Lag Bolts: ASME B18.2.1.

F. Bolts: ASTM A307, Grade A steel bolts with ASTM A563 hex nuts and washers.

G. Expansion Anchors:
   1. Tested in accordance with ASTM E488.
   2. Anchor bolt and sleeve assembly:
      a. Masonry assemblies: Sustain load equal to 6 times load imposed when installed in unit.
      b. Concrete assemblies: Sustain load equal to 4 times load imposed when installed in unit.
   3. Interior applications:
      a. Carbon-steel components.
      b. Zinc plated to comply with ASTM B633, Class Fe/Zn 5.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine conditions under which work is to be installed.

B. Verify measurements, dimensions, and details before proceeding.

C. Coordinate location of furring, nailers, blocking, grounds and similar supports.

D. Correct unsatisfactory conditions.

3.2 INSTALLATION OF ROUGH CARPENTRY

A. Form to shapes indicated.

B. Cut and fit accurately.

C. Set work to required levels and lines, plumb and true.

D. Shim as required.

E. Provide wood grounds or nailers as required for attachment of other work and surface applied items.

F. Grounds:
   1. Dressed, key beveled lumber.
   2. Minimum 1-1/2 IN wide x thickness required to bring face of ground even with finish material.
   3. Remove temporary grounds when no longer required.

G. Wall Blocking:
   1. Provide in-wall fire-treated wood blocking reinforcement where following items are required to be wall-mounted to interior walls:

a. Architectural casework, millwork, cabinets, shelving, wardrobes, and bookcases.
b. Handrails at stairwells.
c. Between studs at height of door stop, behind stop.

2. Metal wall backing:
   a. See Section 09 22 16.

H. Anchor work to support applied loading.
1. Provide washers under bolt heads and nuts.
2. Fasten plywood in accordance with APA recommendations.
3. Use fasteners of size that will not penetrate members where opposite side will be exposed to view or receive finish materials.
4. Predrill holes to avoid splitting wood with fasteners.
5. Do not drive threaded friction type fasteners.

3.3 INSTALLATION OF FIRE RETARDANT TREATED WOOD

A. Fire retardant treated lumber and plywood used in structural applications shall be applied according to lumber and plywood strength tables provided by manufacturer.

B. Use only fasteners approved by the manufacturer of fire-retardant-treated or preservative treated wood.

C. Field Cuts:
1. Dimensional Lumber: Do not rip or mill fire retardant treated lumber.
   a. Cross cuts, joining cuts, and drilling holes are permitted.
2. Plywood: Fire retardant treated plywood may be cut in any direction.
3. Field treat cuts and holes in preservative and fire retardant treated material in accordance with AWPA M4.

END OF SECTION

SECTION 06 20 00
FINISH CARPENTRY

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Finish Carpentry in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Architectural Woodwork Standards (AWS), Premium Grade:

B. American National Standards Institute (ANSI):
   1. ANSI 208.1 Particleboard
   2. ANSI 208.2: Medium Density Fiberboard (MDF) For Interior Applications

1.3 SUBMITTALS

A. Shop Drawings:
   1. Show materials, component profiles, fastening methods, jointing details, and accessories.

B. Product Data:
   1. Cabinet Hardware.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Lumber:
   1. AWS Premium grade suitable for transparent or opaque finish as indicated.
   2. Moisture content: between 5 and 10 percent.
   3. Softwood: Any commercial softwood species.
   4. Hardwood: Birch or poplar.

B. Wood Molding:
   1. Base:
      a. Architectural Millwork Manufacturing Company.
   2. Optional:
      a. Custom Woodworks Limited.

C. Sheet Materials:
   1. Manufactured without urea-formaldehyde resins.
   2. Softwood plywood:
      a. Purpose shall determine types, grades, waterproof or water-resistive construction, and thickness according to "Guide to Plywood Grades under Product Standard PS 1", except as indicated.
      b. Exposed Faces (Interior): Veneer Grade Ponderosa Pine.
   3. Hardwood faced panels:
      a. MDF panel substrate.
      b. Phenolic or paper face over surface to have veneer applied.
      c. Hardwood Face Veneer Plywood:
         1) Species:
         2) Cut:

3) Match:

4. Lumber core plywood:
    1) Species:
    2) Cut:
    3) Match:
5. Medium-density fiberboard (MDF):
    a. Grade 230.
6. Particleboard:
    a. Medium density, Grade M-2
    b. Density: 45 LBS/FT^3.
    c. Thickness:
    d. Exterior glue.
7. Hardboard:
    a. ANSI/AHA A135.4; compressed, inter-felted cellulosic fiber.
    b. Thickness: _____.
    c. Tempered.

2.2 ACCESSORIES

A. Fasteners, Bolts, Nuts, Washers, Lags, Pins and Screws:
    1. Of size and type to suit application, except where specific types are shown.

2.3 SHOP FABRICATION

A. Prepare woodwork to receive items specified in other Sections through use of templates.

B. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes.
    1. Fit corners and joints hairline; secure with concealed fasteners.

C. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

D. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

2.4 FINISHING

A. Field applied transparent or opaque paint finish, including but not limited to shelving; wood stairs and handrails, cased openings, door and window frames; standing and running trim.

B. Finish in accordance with AWS System Section 5, System-9, UV Curable, Acrylated Epoxy, Polyester or Urethane, Green Guard certified; Premium grade.

C. Sand surfaces smooth and set exposed nails and screws.

D. Apply wood filler in exposed nail and screw indentations.

E. On items to receive transparent finishes, use wood filler to match surrounding surfaces and of types recommended for applied finishes.

F. Finish to color and sheen selected.

G. Seal, stain and varnish exposed and semi-concealed surfaces. Seal concealed surfaces.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine conditions under which work is to be installed.

B. Verify measurements, dimensions, and drawing details before proceeding.

C. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.

D. Installation indicates acceptance of substrates and responsibility for performance.

3.2 INSTALLATION

A. Install work plumb, level, securely in place, and with tightly fitted joints.

B. Scribe work abutting other surfaces.
   1. Maximum gap: 1/32 IN.
   2. Do not use additional overlay trim.

C. For wall mounted components, use concealed attachments.

D. Countersink anchors and conceal with solid plugs. Finish flush with adjacent surfaces.

E. Use blind nailing where practicable.

F. Where face nailing is required, set and fill with putty. Finish work smooth.

G. Cope trim and moldings at returns and interior angles, and miter at external corners.

H. Shoulder intersections of flat work to ease any inherent change of plane.

I. Stagger, conceal, or space joints in inconspicuous locations.

J. Minimize joints by using maximum length lumber available.

3.3 PREPARATION FOR FINISH

A. Set nails.

B. Fill holes.

C. Sand smooth before application of finishes.

D. Leave ready for finishing.

3.4 ADJUST AND CLEAN

A. After installation, adjust operating parts.

B. Install temporary coverings to protect installed work.

END OF SECTION

SECTION 06 42 00
WOOD PANELING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Wood Paneling, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM D1037 Standard Test Methods for Evaluating Properties of Wood-Base Fiber and Particle Panel Materials

B. American National Standards Institute (ANSI):
   1. ANSI A208.1 Particleboard

C. Hardwood Plywood and Veneer Association (HPVA):
   1. ANSI/HPVA HP-1 Standard for Hardwood and Decorative Plywood

D. Window and Door Manufacturers Association (WDMA):
   1. ANSI/WDMA I.S.1A Industry Standard for Interior Architectural Wood Flush Doors

E. American Wood Protection Association (AWPA):
   1. AWPA-P49 Standard for Fire Retardant FR-1 (FR-1)
   2. AWPA-C20B Structural Lumber, Fire-Retardant Treatment by Pressure Processes
   3. AWPA-C27B Plywood, Fire-Retardant Treatment by Pressure Processes

F. U.S. Product Standards:
   1. PS 1 Construction and Industrial Plywood.
   2. PS 20 American Softwood Lumber Standard.

G. Federal Specification (FS):
   1. MM-L-736D Lumber; Hardwood

H. Architectural Woodwork Institute (AWI):
   1. AWI Architectural Woodwork Standards.
      a. Grade: Premium.

I. Fabricator Qualifications:
   1. Firm experienced in producing paneling similar to that indicated for this Project.
   2. Member of Architectural Woodwork Institute (AWI).

J. Mock Up:
   1. Erect section of wall panels.
      a. Obtain Architect’s acceptance of visual qualities as well as materials and workmanship.
      b. Protect and maintain approved mock-up as standard for balance of the work.
      c. Approved mock up may be part of permanent installation.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Show fabrication and erection of each condition for architectural woodwork, including plans and elevations.

2. Show flitch matching, jointing, grain direction, identification number for each leaf, anchorage and accessory items, finishes, framing and bracing members.
    a. Identification number shall include the flitch and the sequence within flitch for each leaf.

B. Samples:
1. Veneer Flitches: Minimum 3 full length and width veneer flitches, for selection by Architect prior to preparing fabricated samples.
2. Fabricated samples: Minimum 8 x 10 IN sample of veneered panel fabricated with a minimum of one veneer flitch match.
    a. Sample shall establish and control criteria for graining, color, and texture.
3. Include shop applied stains and transparent finishes on fabricated samples.

C. Project Information:
1. Certification of fire-retardant treatment including name of fire-retardant salts used, compliance with applicable building code requirements and with AWPA Spec C27B for plywood, and that treatment will not bleed through or attack final finish.

D. Contract Closeout Information:
1. Maintenance Data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wood Paneling and other wood items:
1. Base:
    a. Columbia Forest Products.
2. Optional:
    a. Architectural Millwork Manufacturing Co.
    b. VT Industries.

B. Mounting Clips:
1. Base:
    a. Brooklyn Hardware, LLC.
2. Optional:
    a. Monarch Manufacturing.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Shop finished interior wood veneer-faced wall paneling, wainscot and base.

B. Wood Panel Veneer:
1. Plain Sliced, American Red Oak.
2. Minimum Thickness: 0.027 IN.
3. Grain direction:
    a. Vertical.
4. Balance and book match in sequence within panels, and book match across the extent of the installation.
5. Provide veneers to wood door manufacturers to achieve a blueprint match in walls with wood doors.

C. MDF Core for Wood Veneers:
1. Formaldehyde-free, Medium Density Fiberboard (MDF)
2. Density: Not less than 48 LBS/CF
3. Comply with ASTM D1037.
4. Thickness: 3/4 IN or as noted.

D. Solid Lumber Stock:
   1. Hardwood and softwood solid stock:
      a. For use at wood paneling and standing and running trim.
      b. Comply with AWI lumber grading rules.
      c. Surfaced four sides (S4S).
      d. Dimension and profile: As indicated.
   2. Exposed hardwood:
      a. For use at transparent finish.
      b. Maple.
      c. Premium grade.
      d. Quarter sawn.
   3. Exposed hardwood:
      a. For use at opaque finish.
      b. Poplar.
      c. Premium grade.
   4. Softwood:
      a. For use at concealed structures and supports.
      b. Western pine.
      c. Custom grade,

E. Plywood:
   1. General:
      a. Thickness: 3/4 IN, or as noted.Urea-formaldehyde resin free.
   2. Hardwood Plywood:
      a. Maple.
      b. HPVA HP-1
      c. Quarter sawn.
   3. MDO Plywood:
      a. Use at opaque finish.
      b. Medium Density Overlay.
   4. Softwood Plywood:
      a. Use at concealed structures and supports.
      b. AWI Section 200-2, custom grade.

F. Hardwood Lumber Edge Banding:
   1. Hardwood stock.
   2. Premium grade.
   3. Match species of face veneer.
   4. Thickness: 3/4 IN or as required to match panel.Minimum Width: 1/2 IN.
   6. Dimension and Profile: As indicated.
   7. Pressure glue.

G. Veneer Edge Banding:
   1. Wood veneer.
   2. Premium grade.
   3. Match species of face veneer.
   4. Minimum Thickness: 0.027 IN.
   5. Minimum Width: 3/4 IN or as required to match panel.
   6. Pressure glue.

H. Adhesives:
   1. Contact adhesive or as recommended by AWI Quality Standards to suit application.
   2. Plastic laminate application to wood:
      a. Laminate manufacturer’s recommendations.
   3. General interior use to bond wood members:
      a. Type II urea-formaldehyde resin formula or polyvinyl acetate resin emulsion.
      b. Comply with WDMA I.S. 1-A.

2.3 HARDWARE

A. Mounting Clips:
   1. Concealed devices with mating edges; used to secure of panels to substrate.
      a. Type 6005A Aluminum.
      b. Permit installation of panels without exposed fasteners.
      c. Limit lateral movement in direction perpendicular to plane of substrate.
      d. Permit movement parallel to plane of wall.
   2. PanelClip by Brooklyn Hardware, LLC.

B. Fasteners:
   1. Type, size, material and finish as recommended by manufacturer.

2.4 FIRE RETARDANT MATERIAL

A. Meet code requirements for Class I Material

B. Comply with AWPA-P49.

C. Treatment: Pressure treat to meet code requirements and to comply with AWPA-C20B for lumber and AWPA-C27B for plywood.
   1. After fire retardant treatment, kiln dry to a maximum moisture content of 15 percent.
   2. Fire retardant treated wood shall not bleed through, bleach or otherwise attack final finish.

2.5 FABRICATION

A. Verify dimensions by accurate field measurement before fabrication wherever work adjoins other work that precede it in construction.

B. Do not erect or install Paneling in areas until completion of work by other trades that might damage or disfigure the woodwork.

C. Spaces to receive installed woodwork shall be conditioned for a minimum of 48 hours within usage temperature and humidity ranges prior to commencing work and continuing to completion of installation.

D. Wood Paneling shall be constructed in accordance with dimensions and design indicated.

E. Tolerances on overall assembly dimensions shall comply with the applicable AWI standards.

F. Workmanship:
   1. Work shall be fabricated and rigidly assembled.
   2. Reinforcing shall be provided to ensure a rigid and secure assembly.
   3. Exposed surfaces shall be free from dents, toll marks, warpage, buckle, glue and open joints.
   4. Joints, corners and miters shall be accurately fitted.
   5. Threaded connections shall be drawn tightly so that the threads are entirely concealed.

G. Fastening:
   1. Attachment of panels to walls: By concealed mounting clips.
   2. Except where otherwise indicated, the methods of assembly and joining shall be in accordance with AWI standards..
   3. Manufacturer’s proven methods that produce the required standards of workmanship shall be used.
   4. Conceal fastenings wherever possible.

H. Veneered Surfaces:
   1. Face veneers shall be glued by the hot press method, and glued surfaces shall be in close contact throughout.
   2. Glue stains will not be permitted.
   3. Carefully match grain and pattern of wood veneers to receive transparent finish.
   4. Carefully distribute to overall advantage any allowable defects in specified premium grade materials and workmanship.

I. Assembly: Fit and assemble work in shop insofar as practicable.
   1. Mark and disassemble units that are too large for shipment to project site, retaining units in sizes that are appropriate for shipment and erection.

2.6 SHOP FINISHING

A. Transparent Finish:
   1. Stain:
      a. To be selected by Architect.
      b. Match approved sample.
      c. Effect:
         1) Open-grain finish.
   2. Transparent Finish: catalyzed polyurethane.
   3. Apply shop-applied finishes in clean, dustproof environment.
   4. Sand lightly between coats to provide smooth, medium, rubbed effect finish.
   5. Comply with requirements indicated for finish system, staining, effect and sheen.
   6. Grade: Premium.
   7. Sheen:
      a. Satin.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine supporting structure and conditions under which Wood Paneling is to be installed.

B. Correct conditions detrimental to satisfactory completion of work.

C. Examination substrates for excessive moisture content.

D. Verify dimensions before proceeding and obtain measurements at job site for work required to accurately fit with other construction.

E. Coordinate work with that of other trades affected by installation.

3.2 INSTALLATION

A. Prime paint or seal surfaces in contact with cementitious materials.

B. Install wood paneling in compliance with manufacturer’s recommendations and approved shop drawings.

C. Assemble, fit and attach unassembled sections with concealed connections.

D. Firmly secure wood paneling to ground, furring, framing, and other backings.

E. Fit and scribe to adjacent materials accurately.

F. Install wood paneling over wall surfaces by concealed clips.

G. Maintain true, plumb, and level alignment of wood paneling throughout.

H. Maintain reveals and exposed panel terminating edges in constant line and width.

3.3 FINISHES

A. Touch-up and restore shop-applied finishes after installation to eliminate any unsatisfactory appearance.

B. Protect installed work.

END OF SECTION

DIVISION 07

THERMAL AND MOISTURE PROTECTION

SECTION 07 16 04
CONCRETE FLOOR MOISTURE TESTING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Moisture Testing in accordance with provisions of Contract Documents.

B. Completely coordinate with Section 07 16 05, Water Vapor Emission Control System, and work of other trades.

C. Contractor's Responsibilities:
   1. Provide pre-installation coordination with concrete and space acclimatization trades upon building enclosure.
   2. Facilitate testing and inspection and furnish labor to assist Owner's testing agency at site.
   3. Advise Owner's testing agency sufficiently in advance of operations to allow for completion of routine testing and for assignment of personnel.

1.2 QUALITY ASSURANCE

A. Section includes testing agency administrative and procedural requirements for quality assurance and quality control in performing concrete moisture testing for compliance with floor finishes.

B. Testing and inspection services are required to verify compliance with requirements specified or indicated and do not relieve Contractor's responsibility for compliance with Contract Document requirements.

C. Testing Agency Qualifications:
   1. Firm experienced in field of concrete floor moisture testing for projects similar in scope, material, design, and extent indicated for this Project.
   2. International Concrete Repair Institute (ICRI) Certified in moisture and pH testing, conducting ASTM tests, and interpretation of results.

D. ASTM International (ASTM):
   1. ASTM F710 Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring
   2. ASTM F2170 Standard Test Method for Determining Relative Humidity in Concrete Slabs Using in situ Probes
   3. ASTM F2659 Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter.

1.3 SUBMITTALS

A. Project Information:
   1. Prepare schedule of tests and inspections in tabular form and include following:
      a. Specification Section number and title.
      b. Description of test and inspection method.
      c. Identification of applicable standards.
      d. Identification of test and inspection methods.
      e. Number of tests and inspections required.
      f. Time schedule or time span for tests and inspections.
      g. Entity responsible for performing tests and inspections.
      h. Requirements for obtaining samples.
      i. On elevated slabs on metal deck, test at deepest portion of deck flute.
      j. Each test shall be identified by its own unique number directly on concrete and site map.
      k. Digital pictures of testing methods in place.

2. Submit reports of test results and include following:
    a. Date of issue.
    b. Project title and number.
    c. Name, address, and telephone number of testing agency.
    d. Dates and locations of samples and tests or inspections.
    e. Names of individuals making tests and inspections.
    f. Description of Work and test and inspection method.
    g. Record for each test listing interior temperature, humidity, moisture vapor, and alkalinity results for testing period for both new or existing concrete slabs or both.
    h. Test and inspection results and an interpretation of test results.
    i. Provide electronic copy of Architectural Floor Plans identifying each test by number and location where conducted.
    j. Name and signature of laboratory inspector.
    k. Recommendations on retesting and re-inspection.
3. Submit product data on testing equipment and devices used to conduct tests.

B. Contract Closeout Information:
1. Testing Agency shall include closeout document including testing reports, test location maps, submittal information for installed below grade vapor barrier, concrete mix designs, admixtures, curing methods and moisture control products utilized on project.

1.4 SEQUENCING

A. Owner Responsibilities:
1. Owner shall engage qualified Testing Agency to perform testing specified herein and in accordance with Section 01 45 23.
2. Payment for testing services will be made by Owner directly to testing agency.

B. Testing Agency Responsibilities:
1. Cooperate with Contractor and Architect in performance of duties.
2. Provide qualified personnel to perform required tests and inspections.
    a. Provide documented confirmation of previous projects completed of similar size and scope of proposed project.
    b. Technicians conducting or overseeing performance of moisture testing are required to be International Concrete Repair Institute (ICRI) certified to Grade 1, Moisture Testing Technician level.
3. Notify Contractor and Architect promptly of irregularities or deficiencies observed in Work during performance services.
4. Determine locations from which test samples will be taken.
5. Provide test results marked on finish floor plan drawings showing test results with vapor reduction system recommendations.
6. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
7. Submit a certified written report for each test, inspection, and similar quality assurance service to Owner, Architect, and Contractor.

C. Schedule of Tests and Inspections:
1. Allow adequate time for results of tests, inspections and relative humidity control system to conclude prior to erection of interior walls, fixtures and equipment.
2. Prepare a schedule of tests, inspections, and similar quality control services required by Contract Documents.
3. Submit schedule within 30 days of date established for Notice to Proceed.
4. Distribute schedule to Owner, Architect, Contractor, testing agencies, and each party involved in performance of portions of Work where tests and inspections are required.
5. Site Conference: Testing Agency, Owner, Architect, and Contractor shall meet 90 days prior to flooring installation to discuss testing requirements, specifications, and locations prior to testing.

D. Acclimate building to working environment as required by manufacturer requirements of specified flooring materials and in accordance with ASTM F2170 requirements.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable Manufacturers of Testing Equipment:
   1. Base:
      a. Wagner Electronics.
   2. Optional:
      a. American Moisture Test.
      b. Delmhorst Instrument Co.
      c. Tramex.

B. Testing equipment shall be from single source, meeting specified requirements:
   1. Alkalinity (pH): ASTM F710.
      a. Wide Range 1-14pH.
   2. Relative humidity (RH): ASTM F2170.
      a. Relative humidity range of 0-100 percent.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Building weatherproof, exterior doors installed and windows secured.

B. Do not start testing process when concrete installation is less than 90 days of age, building slabs contain standing water, presence surface contaminates, exposed to exterior conditions, or slabs have been rewetted.

3.2 PREPARATION

A. Prepare test sites per ASTM F710 and ASTM F2170.

B. Conditioning: Minimum 48 hours prior to testing:
   1. Concrete floor slabs: Service temperature.
   2. Occupied air space above the floor slab: Service temperature.
   3. Occupied air space relative humidity above floor slab: Service humidity.
   4. Continue conditioning required until and during floor installation.

C. Clearly mark each test location on floor plan and directly on concrete surface with non-removable marker.

3.3 TESTING

A. Test concrete for each area of each non-permeable flooring type.

B. Perform tests at rate of 3 tests for areas up to 1000 SF , and 1for each 1000 SF thereafter.

C. HVAC system shall be operational during testing period and for a minimum period of 60 days preceding tests.
   1. Record temperature and humidity readings at start and end of testing.
   2. Continue conditioning after flooring installation as required by applicable manufacturers.
   3. If proper conditions cannot be achieved during construction process and testing is performed results shall be used as preliminary information only.
      a. Re-testing when conditions are achieved or application of Section 07 16 05 scope is required.

D. Perform in-situ probe tests per probe manufacturer’s specifications with regard to temperature and humidity of space being tested.

1. Proof of calibration is required for each sensor prior to use.
2. Test conditions: 60 degF +/-10 degrees with 50 percent +/-10 percent relative humidity.

E. Perform digital Alkalinity (pH) tests within water vapor emission test dome.
1. Test in accordance with ASTM F710 and manufacturer's recommendations.
2. Apply manufactures recommended liquid to form 1 IN diameter puddle.
3. Allow liquid to absorb for 60 seconds.
4. Expose probe to liquid and allow meter to calculate pH level for 10 seconds.
5. Document results to nearest hundredth.

F. Perform Relative Humidity (RH) tests.
1. Test in accordance with ASTM F2170 and manufacturer's recommendations.
2. Drill hole to diameter and length required for concrete thickness.
3. Remove concrete debris by compressed air and vacuuming holes.
4. Place RH probe sleeve in opening, secure cap and allow acclimating for minimum 72 hours.
5. Protect from wet work and trade traffic.

G. Acceptable readings during HVAC operation shall be in accordance with following:
1. Relative Humidity Level per ASTM F2170: Less than 75 percent.
2. Alkalinity-pH per ASTM F710: Acceptable Range 7.0 pH to 9.0 pH.

H. Section 07 16 05 Water Vapor Emission Control System is required where test results are found unacceptable per flooring manufacturer installation recommendations and requirements.

3.4 POST-INSTALLATION TESTING

A. Coordinate and conduct tests for moisture vapor emissions and alkalinity prior to placement of cementitious surfacing per ASTM F2659 Standard Guide for Preliminary Evaluation of Comparative Moisture Condition of Concrete, Gypsum Cement and Other Floor Slabs and Screeds Using a Non-Destructive Electronic Moisture Meter.

B. Re-test locations where system is found to be deficient following repair prior to commencement of topping installation and scheduled floor covering products.

END OF SECTION

SECTION 07 16 05
WATER VAPOR EMISSION CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Water Vapor Emission Control System, as indicated, in accordance with provisions of Contract Documents.

B. Coordinate with Section 01 35 32, Interim Infection Control Measures (IICM), and Section 07 16 04, Concrete Floor Moisture Testing, and work of other trades.

1.2 SYSTEM DESCRIPTION

A. Water Vapor Emission Control System:
   1. Two component fluid applied epoxy based coating which restricts excessive levels of relative humidity and extreme alkalinity readings at below-grade, on-grade and suspended concrete floor slabs for compliance with subsequent floor coverings or coating materials.
   2. Primer: Non-porous primer.
      a. Single or two-component moisture tolerant primer as recommended by manufacturer of control system.
   3. Cementitious Surfacing: Required to provide a smooth porous substrate suitable for application of finish flooring.
      a. Self-leveling, calcium aluminate base formula.
      b. Compressive strength: 4,100 PSI minimum.
      c. Nominal thickness of 1/8 IN to1/4 IN over treated floor surface as required by system manufacturer.
   4. Provide 100 percent coverage of interior on grade, below grade, and slab on deck floor areas.

1.3 QUALITY CONTROL

A. Single source responsibility for Water Vapor Emission Control System including but not limited to:
   1. Mechanical preparation of concrete surfaces.
   2. Application of system components.
   3. Placement of cementitious surfacing.

B. Install specified, or Manufacturer approved, products from one source to provide products of consistent quality in appearance and physical properties.

C. Manufacturer Qualifications:
   1. Minimum five (5) years in production of water vapor emission control system products.
   2. Meet source limitations and assume responsibility for performance of materials supplied by or approved by Manufacturer for this scope.
   3. Product Liability Insurance in amount of not less than five (5) million dollars per occurrence.
   4. Warranty program covering cost associated with failure of system components, labor and collateral product failure as result, per section warranty requirements.

D. Installer Qualifications:
   1. Firm with not less than five (5) years of successful installations.
   2. Equipment required to prepare concrete and apply products per manufacturers requirements for warranted installation.
   3. Submit a minimum of five (5) references of projects similar in size and scope.
   4. Personnel employed or trained and certified by system manufacturer.

E. Low emitting product with less than 65 g/liter VOC content.

F. Pass California Department of Health Services - Section 01350 Toxic VOC testing.

G. Preinstallation Conference:
   1. See Section 01 31 19.

1.4 SUBMITTALS

A. Product Data:
   1. Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product used in compliance with specifications.

B. Project Information:
   1. Independent ASTM testing reports.
   2. Manufacturers installer certificate.
   3. Sample certificate of Warranty.
   4. Sample certificate of Product Liability Insurance.
   5. Manufacturer certification products comply with 1.3 Quality Assurance requirements.
   6. Minutes from Preinstallation Conference.

C. Contract Closeout Information:
   1. Warranty:
      a. Provide upon completion of Water Vapor Emission Control System installation.
   2. Certificate of Product Liability Insurance.
   3. Test result documentation of post cure and post seal control application for alkalinity- pH tests.
      a. Indicate test locations and results on electronic copy of floor plans.

1.5 WARRANTY

A. Manufacturer shall provide materials and labor for repair or replacement of damaged finish flooring system and remedial work to replace Water Vapor Emission Control System in event of treatment system failure for a period of fifteen (15) years, including:
   1. Deficiencies in system resulting from installation or manufacturing defects.
   2. Material and labor to replace damaged finish flooring due individually or in combination to, concrete moisture, relative humidity, alkalinity, or any combination, from substrate originated sources, joints, cracks, or any combination.
   3. Concrete cracks, joints and slab imperfections after application.
   4. Mitigation of biological growth, if present.
   5. ACI-318, dew point, concrete salts, admixtures, resin, and silicate surface treatments.

B. Warranty shall be underwritten by product liability insurance carrier having a minimum Secure "A" rating by A. M. Best, or equivalent rating system, in amount of five million ($5,000,000) dollars per occurrence.

C. Prior to commencement of finished flooring materials, deliver warranty as confirmation substrate is prepared and ready to accept commercial floor covering products specific to project requirements.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Water Vapor Emission Control System:
   1. Base:
      a. Allied Construction Technologies, AC Tech 2170.
      b. Aquafin International, Vaportight Coat SG3.
      c. Ardex Engineered Cements, MC PLUS Moisture Control.
      d. Concrete Curative Systems, LLC. CCS - S2
      e. Floor Seal Technology, MES 100; 3 coat system.
      f. Koster American, VAP I 2000.

g. Mapei, Apac 70.

B. Other Manufacturers desiring approval comply with provisions in Section 00 26 00.

2.2 MATERIALS

A. Water Vapor Emission Control System:
1. For use over normal and lightweight concrete floor slabs, suspended or on grade.
2. 100 percent epoxy resin solids.
3. Topical fluid applied
4. One or two component high density.
5. Chemically enhanced.

B. Primer:
1. Single or two-component moisture tolerant cement primer recommended and provided by manufacturer.

C. Cementitious Surfacing:
1. Self-leveling Portland cement based product approved and provided by manufacturer.
2. Compressive strength: 4,100 PSI , minimum.

D. Product Performance, Spread Rate:
1. Application of concrete water vapor emission control system shall maintain tolerances with the below performance requirements after application:
   a. Alkalinity Resistant of 14pH, ASTM F710: 100 percent tolerant.
   b. Relative Humidity Rates, ASTM F2170: 100 percent RH tolerant.

E. Laboratory Performance:
1. Water Vapor Transmission, wet method, ASTM E96: Minimum 95 percent moisture reduction.
2. Alkali-14pH Resistance, ASTM D1308: No effect at 30 day exposure.
3. Potassium Hydroxide Resistance, ASTM D1308: No effect at 30 day exposure.
4. Adhesion Strength, ASTM D7234: 100 percent concrete failure.

F. Testing: See Section 07 16 04.
1. Concrete vapor emission, alkalinity-pH, and relative humidity-RH testing.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Review concrete mix designs, admixtures, sub slab vapor barrier and curing methods.

B. Install in accordance with control system manufacturer instructions in compliance with independent digital alkalinity-pH test lab report for concrete moisture per ASTM F710 and relative humidity per ASTM F2170.

C. Installation constitutes acceptance of substrate and responsibility for system performance.

3.2 PREPARATION

A. Protect work space and labor force from exposure to silica dust during preparation and application process by following requirements of Section 01 35 32.

B. Edge grind near wall base, columns, edges and difficult to reach areas prior to shotblasting.

C. Abrade concrete surfaces using No. 390 - 420 shot to create an International Concrete Repair Institute (ICRI) No. 3 -5 profile or as recommended by water vapor emission control system manufacturer.

D. Overlap edge grinding.

E. Clean joints using a crack chasing blade to remove debris.

F. Broom-sweep and vacuum all surfaces slab surfaces to remove dust and debris.

G. Do not use clean sweeping agents or chemicals to clean surface.

3.3 CONTROL SYSTEM COATING INSTALLATION

A. Install system components with manufacturer trained, certified or employed personnel.

B. Saturate cracks and joints with control system material to seal inner walls of crack or joint, then fill with flexible sealant or control system as recommended by manufacturer.

C. Apply control system coating and surface irregularities with manufacturer approved two-component epoxy resin fill, and allow to cure and set prior to application of control system coating at rate recommended by manufacturer based upon test data.

D. Allow to cure and set in accordance with manufacturers recommendations.

E. Verify product thickness using a digital mil gauge at minimum of twenty (20) locations.
   1. Report results to manufacture's technical representative for written approval and warranty registration.

3.4 FIELD QUALITY CONTROL

A. Prior to placement of cementitious surfacing, coordinate post-installation tests for moisture vapor emissions and alkalinity at areas receiving Water Vapor Emission Control System.
   1. See Section 07 16 04.

B. Correct deficiencies, where tests do not meet specified levels, as recommended by manufacturer of Water Vapor Emission Control System, prior to commencement of topping installation and scheduled floor covering products.

C. Final surfaces shall be compatible with floor coverings and require no special floor adhesives or methods and confirm product meets or exceeds requirements of flooring covering sections.

3.5 CEMENTITIOUS SURFACING INSTALLATION

A. Prepare to install cementitious surfacing after mil thickness testing verifies proper application rates of control system.

B. Apply primer, if required by cementitious surfacing installation, over control system surfaces at rate recommended by manufacturer.

C. Allow primer to dry for maximum adhesion between control system and cement topcoat, or as recommended by water vapor emission control manufacturer.

D. Place cementitious surfacing in 1/8 IN to1/4 IN thickness to produce smooth flooring compatible surface.

E. Protect finished surfaces from construction damage, contamination of oil, grease, paint, sweeping compounds prior to installation of finish flooring materials.

END OF SECTION

SECTION 07 21 00
BUILDING INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Building Insulation in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International:
   1. ASTM C665 Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing .
   2. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials.
   3. ASTM E136 Standard Test Method for Behavior of Materials in a Vertical Tube Furnace at 750°C.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturers' product data sheets, details and installation instructions including components and accessories, indicating product is in compliance with specifications.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Rigid Board Insulation Extruded Polystyrene (XPS):
   1. Base:
      a. Dow Chemical.
   2. Optional:
      a. Owens-Corning.

B. Fiberglass Batt Insulation:
   1. Base:
      a. Owens-Corning.
   2. Optional:
      a. CertainTeed
      b. Johns Manville.
      c. Knauf Insulation.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Rigid Board Insulation - Extruded Polystyrene Foam (XPS):
   1. Minimum Compressive Strength:
      a. 40 PSI. (type VI)
   2. Minimum thickness: 1 IN or as otherwise shown or required.

B. Unfaced Fiberglass Batt Insulation:
   1. Inorganic fibers and resinous binders formed into flexible blankets or semi-rigid sheets.

2. Un-faced, Type I in accordance with ASTM C665.
3. Minimum Surface Burning Characteristics per ASTM E84: Flame Spread: <25; Smoke Developed: <50.
4. Combustion characteristics: Noncombustible; unfaced per ASTM E136.
5. Manufactured without urea-formaldehyde binders.
6. Nominal Thickness / Thermal Resistance Value, measured at 75 DegF:
   a. Nominal Thickness: 3-1/2 IN or 6-1/2IN to match stud depth.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Installation indicates acceptance of responsibility for performance.

3.2 INSTALLATION

A. General:
   1. Insulate full thickness over surfaces to be insulated.
   2. Fit tightly around obstructions, fill voids.
   3. Cover penetrations with insulation.
   4. Comply with manufacturer's instructions for installation unless more stringent requirements are specified.
   5. If manufacturer's instructions are not available, or not applicable, consult manufacturer's technical representative for specific recommendations prior to installation.
   6. Do not use broken or torn pieces of insulation.
   7. Provide minimum cover of 5/8 IN type X gypsum wallboard over exposed foam surfaces.

B. Un-Faced Batt Insulation:
   1. Installing Batts:
      a. Friction fit un-faced batts between studs.
      b. Tightly butt ends.
      c. Where specified thickness of batts is less than the depth of framing, install retaining devices to prevent sagging.

END OF SECTION

SECTION 07 53 25
FULLY ADHERED EPDM ROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Fully Adhered EPDM Roofing in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Manufacturer authorized roofing installer.

B. Component products produced by single manufacturer or approved for use by roofing manufacturer to achieve a warranted system.

C. ASTM International (ASTM):
   1. ASTM C1289 Standard Specification for Faced Rigid Cellular Polyisocyanurate Thermal Insulation Board
   2. ASTM C1303 Standard Test Method for Predicting Long-Term Thermal Resistance of Closed-Cell Foam Insulation
   3. ASTM D312 Standard Specification for Asphalt Used in Roofing
   4. ASTM D4637 Standard Specification for EPDM Sheet Used in Single-Ply Roofing
   5. ASTM D4811 Standard Specification for Non-vulcanized Rubber Sheet Used as Roof Flashing
   6. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
   7. ASTM E96 Standard Test Methods for Water Vapor Transmission of Materials

D. American National Standards Institute (ANSI) / Single Ply Roofing Industry (SPRI):
   1. ANSI/SPRI RP-4 Wind Design Standard for Ballasted Single-Ply Roofing Systems

E. National Roofing Contractors Association (NRCA):
   1. Roofing and Waterproofing Manual

F. Sheet Metal and Air Conditioning Contractors' National Association (SMACNA):
   1. Architectural Sheet Metal Manual

G. Underwriters Laboratories (UL):
   1. 790, Standard for Tests for Fire Resistance of Roof Covering Materials

H. Concrete Moisture Vapor Testing:
   1. Coordinate maximum moisture allowed in concrete deck with roofing manufacturer.
   2. Test concrete decks for moisture in accordance with Section 07 16 04.
   3. If moisture content exceeds manufacturer’s recommendation, install moisture control system per Section 07 16 05.
   4. Static pressure of building interior: < 0.5 IN water.

I. Fire Resistance Rating:
   1. UL 790, Class A.
   2. Assembly in conformance with fireproofing as specified.

J. Preinstallation Conference:
   1. See Section 01 31 19.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Roof layout showing insulation thicknesses and details.
   2. Indicate location of expansion joints, crickets, saddles, curbs, safety tiebacks, vents, drains and other penetrations.
   3. Indicate slope direction, slope amount, and key vertical elevation points.
   4. Indicate components included for installation including anchor plate configuration.
   5. Profiles of flashing assemblies.
   6. Installation Drawings.

B. Product Data:
   1. Manufacturer standard literature for vapor barrier, insulation and roofing system components, including adhesives and accessories indicating compliance with specification requirements.
   2. Manufacturer standard literature for roof coping system indicating components and accessories including anchor plate configuration.

C. Samples:
   1. Roofing manufacturer's facsimile of each sheet metal color for pre-selection.
   2. 3 IN x 5 IN samples of roofing manufacturer's sheet metal color for final approval.

D. Project Information:
   1. Minutes from Preinstallation Conference.

E. Contract Closeout Information:
   1. Warranty.
   2. Maintenance Data:
      a. Include cleaning instruction.
      b. See Section 01 78 23.

1.4 WARRANTY

A. Manufacturer's standard fifteen (15) year warranty of weathertightness signed by roofing materials manufacturer.
   1. Warranty to include coverage for peak gusts of wind to:
      a. 55 MPH at 33 FT above ground.
   2. Warranty to include the entire system: membrane, flashings, adhesives, sealants, counterflashings, insulation, fasteners, fastener plates, fastener strips, hard rubber or metal edging, metal termination bars, sheet metal copings and edge metal, and other material authorized by manufacturer.

B. Manufacturer's twenty (20) year warranty on 70 percent PVDF, Kynar 500, coatings on edge metal and copings.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fully Adhered EPDM Roofing:
   1. Base:
      a. Carlisle Syn Tec Systems
   2. Optional:
      a. Firestone Building Products
      b. Johns Manville

B. Sheathing:
   1. Base:
      a. Georgia-Pacific.

2. Optional:
    a. Same as roofing manufacturer.
    b. USG Corporation.
    c. National Gypsum.

C. Vapor Retarder (VR):
1. Base:
    a. Same as roofing manufacturer.

D. Sheet Metal Coping and Edge Metal:
1. Base:
    a. Same as roofing manufacturer.

E. Other Materials:
1. Base:
    a. Manufacturers as noted.

F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

A. Determine per Wind Load Design Guide for Low Sloped Flexible Membrane Roofing Systems published by SPRI.

B. Design roof system and anchorage fastener type and spacing needed to resist uplift pressures including roof covering and metal edge securement to meet design loads and satisfy requirements of applicable building codes, local amendments, and ANSI/SPRI RP-4.

C. Wind loads: Use the greater of the following:
1. Wind pressures as required per local building code based on wind speed, exposure factor and importance factor noted in Structural Drawings.
2. Wind pressures defined by 2010 CBC part two, volume 2 with OSHPD amendments.

D. Requirements applicable to designated warranty.

E. Roof height and parapet height: As indicated.

F. Static pressure of building interior: < 0.5 IN water.

2.3 MATERIAL

A. Gypsum Sheathing:
1. Install over steel deck or existing roofing materials.
2. Water-resistant gypsum core with fiberglass facings.
3. Minimum Thickness: 5/8 IN.
4. Dens-Deck Roof Board by Georgia-Pacific.

B. Vapor Retarder:
1. Rubberized asphalt membrane adhered to polyethylene or polyolefin top sheet.
2. 30 mil thick, minimum.
3. Vapor Permeance: Not exceeding 0.05 Perm US.
4. Primer or adhesive as recommended for substrate by manufacturer.
5. 725TR by Carlisle Syn Tec Systems

C. Polyethylene Sheet Vapor Retarder:
1. Fire retardant type, with compatible fire retardant adhesive.

D. Roof Insulation:
1. Furnished by roofing manufacturer.
2. Polyisocyanurate roof insulation.
3. UL listed for assembly indicated.
4. Rigid, closed cell foam core bonded to heavy-duty glass fiber mat facers.
5. ASTM C1289 Type II, Class 1.

6. R-value: 5.6 per inch in accordance with ASTM C1303, CAN/ULC S770.
7. Compressive Strength: 20 PSI minimum per ASTM D1621, Grade 2.
8. Dimensional Stability: 2 percent maximum linear change in seven days per ASTM D2126.
9. Minimum Insulation Thickness:
    a. Areas where tapered insulation is indicated:
        1) Minimum R-25 at roof drains.
        2) Taper to provide slope of 1/4 IN per FT.
    b. Areas with uniform insulation thickness (sloped structures):
        1) Minimum R-25 at roof drains.
10. Provide crickets and saddles as required.
11. HP-H Polyisocyanurate by Carlisle Syn Tec Systems.

E. Extruded polystyrene (XPS) Roof Insulation:
1. Comply with ASTM C578.
2. Minimum Compressive Strength:
    a. 40 PSI, Complying with ASTM C578, Type VI.
3. Minimum Thermal Resistance: R-5/IN or greater.
4. Minimum Insulation Thickness:
    a. Areas where tapered insulation is indicated:
        1) Minimum R=20 at roof drains.
        2) Taper to provide slope of 1/4 IN per FT.
5. Acceptable manufacturer approved by roofing manufacturer.

F. Cover Board:
1. Water resistant gypsum core with fiberglass facings.
    a. Minimum Thickness: 5/8 IN.
2. Pre-primed.
3. Base: As approved by roofing manufacturer.
4. Optional: Dens-Deck Prime Roof Board by Georgia-Pacific.

G. Roofing Membrane:
1. Ethylene propylene diene terpolymer (EPDM).
    a. Comply with ASTM D4637.
2. Polyester reinforced.
    a. Comply with ANSI/RMA IPR-2.
3. Minimum physical properties:
    a. Thickness: 60 mil.
    b. Breaking Strength: 90 LBS minimum by ASTM D751, grab method.
    c. Ultimate Elongation: 250 percent minimum by ASTM D412.
    d. Tearing Strength: 10 LBF minimum by ASTM D751, B tongue tear.
    e. Factory Seam Strength: Tested to membrane rupture by ASTM D816, modified.
    f. Fire Retardant.
    g. Color: Black.
4. Sure-Tough by Carlisle Syn Tec Systems.

H. Membrane Flashings, Fasteners, Adhesives, Tapes and Sealants:
1. Roofing manufacturer’s standard.

I. Edge Metal and Coping:
1. Roofing manufacturer’s pre-engineered, prefabricated system for termination of roofing membrane.
2. Obtain approval in writing by roofing manufacturer for field fabricated components to ensure a warranted system.
3. Design for wind pressure indicated for balance of roof system.
4. Conceal fasteners from view.
5. Conceal splice plates, with color matching snap-on covers.
6. Anchor cleats:
    a. Material: G90 galvanized steel.

b. Thickness: 20 GA.

7. Snap-on cover:
   a. Material: G90 galvanized steel.
   b. Thickness:
      1) For dimensions less than 10 IN: 24 GA.
      2) For dimensions 10 to 24 IN: 22 GA.
   c. Finish: 70 percent PVDF Kynar 500.
   d. Color:
      1) To be selected from manufacturer's standard colors by Architect.
8. Roof Edge/Fascia:
   a. Include accessories such as pre-fabricated inside and outside corners, spill out, overflow and downspout scuppers, edging extensions, fascia sumps, and other items indicated.
   b. SecurEdge 200 Fascia by Carlisle Syn Tec Systems.
9. Coping:
   a. Include accessories such as pre-fabricated inside and seamed outside corners, end caps, saddles, tees, crosses, transition pieces and radius copings, and other items indicated.
   b. SecurEdge 200 Coping by Carlisle Syn Tec Systems.

J. Fasteners:
1. Type, spacing and quantity as recommended by manufacturer.
   a. Designed to resist uplift forces generated by specified wind speed.
2. Minimum pullout values per fastener:
   a. For use with 22 GA steel decks: 350 LBS each.
   b. For use with normal weight concrete decks: 800 LBS each.
3. Fasteners shall be capable of providing a static back-out resistance of at least 10 IN-LBS.

K. Molded Walkway Pads:
1. Molded rubber walkway pad with slip resistant surface.
2. Color: Same as membrane.
3. Nominal Thickness: 3/16 IN.
4. Length and Width: 30x30 IN.
5. Include adhesive or pressure-sensitive tape as recommended by membrane manufacturer.
6. Locate where indicated.
   a. Do not locate within 10 FT of roof edge.

L. Miscellaneous Items:
1. Color Coating:
2. Roofing accessories:
   a. Use manufacturer's standard prefabricated accessories where available.
   b. Nailing strips: As detailed and required.
   c. Pipe flashings: Provide for each pipe penetration; include clamps, adhesive and sealants.
   d. Expansion joint covers.
   e. Underlayment for pavers: As recommended by roofing manufacturer.
3. Adhesives, cleaners, and primers: As recommended by roofing manufacturer.
4. Fire-retardant Treated (FRT) wood blocking: Specified in Section 06 10 53.
5. Other materials as required by manufacturer for complete system warranty.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Inspect entire area to be roofed for acceptability.

B. Surface on which insulation or roofing membrane is applied shall be clean, smooth, dry, and free of projections such as fins, sharp edges or foreign materials.

C. Correct unsatisfactory conditions.

D. Commencement of roofing activities constitutes acceptance of conditions affecting installation and roofing system performance.

3.2 INSTALLATION

A. Sheathing:
   1. Apply per UL requirements.
   2. Lay sheathing tightly butted and cut to fit around penetrations.
   3. Attach sheathing to deck in accordance with roofing manufacturer’s recommendations.

B. Vapor Retarder:
   1. Install in largest practical widths.
   2. Bond vapor retarder to substrate using approved adhesive.
   3. Install continuously.
      a. Ensure surfaces to be taped are clean and dry.
      b. Insure that no discontinuities occur, including at seams, penetrations, and edge terminations.
      c. Join sections of vapor retarder and lap seams in direction of water flow.
      d. Continuously seal roof vapor retarder to wall air and moisture retarder.
   4. Seal around pipes, conduits, curbs, safety tie-backs, and other penetrations with pipe boots in accordance with manufacturer’s instructions.
   5. Maintain continuity of vapor retarder over expansion joints.
   6. Repair holes in vapor retarder with method and material recommended by manufacturer.
   7. Protect vapor retarder from damage until covered with insulation.

C. Wood Nailers:
   1. Design to resist a minimum of 200 LBS/LF in any direction per SPRI Test Method RE-1.
   2. Provide where indicated or required for proper securement of roofing system.
   3. Install top of blocking flush with top of insulation.

D. Insulation:
   1. Attach with adhesive in full spray or beads in accordance with roofing manufacturer's recommendations.
   2. Where required thickness of insulation is greater than 2 IN: Install insulation in at least 2 layers.
   3. Cut insulation neatly to fit around roof penetrations and projections.
   4. Butt joints tightly.
   5. Install overlay board over insulation.
      a. Fasten through overlay board and insulation to deck.

E. Cover Board:
   1. Install cover board continuously over insulation.
   2. Secure to substrate in same manner specified for insulation securement.

F. Membrane:
   1. Do not allow grease, fats, oils and other contaminants to contact roofing membrane.
   2. Unroll and position membrane without stretching.
   3. Position sheets to accommodate contours of roof deck.
   4. Apply bonding adhesive in accordance with manufacturer's instructions, to underside of membrane and substrate.
   5. Roll coated membrane into coated substrate.
      a. Avoiding wrinkles.
   6. Membrane splices:
      a. Comply with manufacturer’s instructions for splicing procedures.
      b. Locate field splices away from low areas and drain sumps.
      c. Shingle splices to avoid bucking water.

7. Membrane flashing:
    a. Flash penetrations and walls with cured EPDM membrane or flashing.
    b. Exceptions:
        1) Limit uncured flashings and pressure sensitive uncured flashing to overlaying of vertical seams, flashing of inside and outside corners, scuppers, and other unusually shaped penetrations.
        2) Utilize manufacturer's standard pre-manufactured accessories.
    c. Terminate base-of-wall flashings in accordance with manufacturer's approved details.
    d. Pre-flashing at sheet metal parapet copings:
        1) Extend EPDM membrane and/or flashing over top of parapet prior to capping with sheet metal.
    e. Expansion joints:
        1) Extend EPDM membrane across roofing expansion joints.
        2) Include adequate slack in membrane to accommodate anticipated movement.
8. Hot or cold weather procedures:
    a. Comply with manufacturer's instructions.

G. Edge Metal and Coping:
1. Sub-flash details with a layer of EPDM membrane prior to installation of edge metal or coping system.
2. Secure anchor cleat to blocking as recommended, using corrosion-resistant fasteners.
3. Install splice plates and snap-on covers.

H. Walkways:
1. Install walkways at traffic concentration points, such as roof hatches, access doors, rooftop ladders, or locations as indicated.
2. Do not locate within 10 FT of roof edge.
3. Clean surfaces to be bonded.
4. Secure as recommended by membrane manufacturer.

I. Protection:
1. Seal system at end of work day to temporarily close membrane to prevent water infiltration.
2. Remove temporary water cutoffs prior to proceeding with Work.
3. Remove and replace wet insulation.

3.3 SCHEDULE OF ROOF SYSTEMS

A. Roof System 1 - Fully Adhered EPDM over Steel Deck:
1. Gypsum sheathing.
2. Vapor retarder.
3. Insulation.
    a. Mechanically fastened or adhered to deck.
4. Cover Board.
5. EPDM Membrane, adhered.

B. Roof System 2 - Fully Adhered EPDM over Concrete Deck:
1. Vapor retarder.
2. Insulation.
    a. Mechanically fastened or adhered to deck.
3. Cover board.
4. EPDM membrane, adhered.

END OF SECTION

SECTION 07 62 00
FLASHING AND SHEET METAL

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Flashing And Sheet Metal, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM A153 Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware
   2. ASTM A167 Standard Specification for Stainless and Heat Resisting Chromium Nickel Steel Plate, Sheet, and Strip
   3. ASTM A176 Standard Specification for Stainless and Heat-Resisting Chromium Steel Plate, Sheet, and Strip
   4. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   5. ASTM B209 Standard Specification for Seamless Carbon-Molybdenum Alloy-Steel Boiler and Superheater Tubes
   6. ASTM B290 Standard Specification for Carbon and Alloy Steel Forgings for Rings for Reduction Gears
   7. ASTM B308 Standard Specification for Steel Sheet, Terne (Lead-Tin Alloy) Coated by the Hot-Dip Process
   8. ASTM F2329 Standard Specification for Zinc Coating, Hot-Dip, Requirements for Application to Carbon and Alloy Steel Bolts, Screws, Washers, Nuts, and Special Threaded Fasteners

B. Sheet Metal and Air Conditioning Contractors National Association (SMACNA):
   1. Architectural Sheet Metal Manual

1.3 SUBMITTALS

A. Shop Drawings:
   1. Dimensioned drawings of profiles and shapes.
   2. Plans and elevations to show locations of each shape.

B. Samples:
   1. For finish, color and color range selection.

C. Contract Closeout Information:
   1. Warranty.

1.4 WARRANTY

A. Furnish twenty (20) year finish warranty on PVDF coated sheet metal, covering color, fade, chalking and film integrity.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Formed Sheet Metal items:
   1. Base:
      a. Ryerson Metals, ColorKlad.
   2. Optional:
      a. Berridge Manufacturing Company.
      b. Petersen Aluminum, PAC-CLAD.

B. Reglets:
   1. Base:
      a. Fry Reglet.

C. Other materials:
   1. Base:
      a. Manufacturers as noted.
   2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Sheet Metal – Galvanized Steel with PVDF coating.
   1. ASTM A653 galvanized steel, Z275 G90.
   2. Minimum thickness:0.024 IN or as noted for individual fabrications.
   3. Smooth.
   4. PVDF coating: Minimum 1 mil fluorocarbon coating, 70 percent PVDF.
      a. Color:
         1) To be selected by Architect from manufacturer's standard line.
      b. Multiple colors: Architect reserves the right to select a maximum of __ different colors

2.3 SHEET METAL FABRICATIONS

A. Formed Roof Edge Flashing, Gravel Stop and Fascia Coping:
   1. Fabricate to size and profile indicated.
   2. Supply sections with minimum length of 96 IN, but not exceeding 10 FT.
   3. Joint Style:
      a. 1/4 IN Butt Joint with 6 IN wide, exposed cover plate.
   4. Integral Scuppers:
      a. Locate integral scuppers along length of roof edge.
         1) Space 10 FT apart where continuous gutter is indicated.
      b. Fabricate to dimensions indicated. Include a minimum 4 IN wide flanges on 3 sides for embedment into roofing system.
      c. Fasten gravel guard angles to base of scupper where applicable.

B. Formed Sheet Metal Copings:
   1. Fabricate to size and profile indicated.
   2. Supply sections with minimum length of 96 IN, but not exceeding 10 FT.
   3. Fabricate joint plates of same sheet thickness as copings.
   4. Securement:
      a. External Leg: Continuous cleats, no exposed fasteners.
      b. Internal Leg: Color-matched fasteners in slotted holes.
   5. Miter corners, seal, and solder or weld watertight.
   6. Joint Style:
      a. 1/4 IN Butt Joint with 6 IN wide, exposed cover plate.

C. Hanging Gutters:
   1. Fabricate to size and profile indicated, complete with end pieces, outlet tubes, and other accessories as required.
      a. Gutters shall be complete with mitered corners, end caps, and outlets sized to fit downspouts.
   2. Material:

Hanging Gutters - Minimum Sheet Thickness / Weight				
Material	Gutter Girth			
	up to 20 IN	21 to 25 IN	26 to 30 IN	31 to 35 IN
PVDF coated Galvanized Steel	0.024 IN	0.034 IN	0.040 IN	0.052 IN

   3. Fabricate sections in maximum lengths practical; not less than 96 IN long.
   4. Furnish flat-stock gutter spacers and gutter brackets fabricated from same metal as gutters, of size recommended by SMACNA but not less than twice gutter thickness.
   5. Fabricate expansion joints, expansion-joint covers, gutter bead reinforcing bars, and gutter accessories from same metal as gutters.
   6. Gutter supports shall be adjustable minimum 1 IN wide by minimum 0.080 IN thick hanger, provided in sufficient number to be located at maximum 30 IN on center, or minimum 0.032 IN thick continuous cleats.
   7. Expansion Joints: Lap or Butt types.

D. Downspouts:
   1. Fabricate downspouts to size and profile indicated in minimum 10 FT lengths with section ends formed for minimum 1/2 IN telescoped and locked joints with formed or mitered elbows.
   2. Match material and thickness to gutter material.
   3. Shape: Rectangular.
   4. Furnish with metal hangers, from same material as downspouts, and anchors.
   5. Provide wire ball strainers for gutter outlets, elbows and offsets.
   6. Downspout supports:
      a. Minimum 0.040 IN thick clips.
      b. Minimum 0.125 IN thick anchors.
      c. Minimum 0.060 IN thick by 2 IN wide leader straps or rack and pin type fasteners.
         1) Provide a minimum 1 IN clearance between downspout and building wall.
         2) Locate at maximum 5 FT on center.
         3) Use SMACNA standard detail appropriate for downspout.

E. Through Wall Parapet Scuppers:
   1. Fabricate scuppers of dimensions indicated with closure flange trim to exterior, 4 IN wide wall flanges to interior, and base extending 4 IN beyond cant or tapered strip into field of roof.
      a. Fasten gravel guard angles to base of scupper.

F. Conductor Heads:
   1. Fabricate conductor heads with flanged back and stiffened top edge and of dimensions and shapes indicated.
   2. Include outlet tube and exterior flange trim.
   3. Include built-in overflows where indicated.

2.4 ACCESSORIES

A. General:
   1. Provide materials and types of fasteners, solder, welding rods, protective coatings, separators, sealants, and other miscellaneous items as required for complete sheet metal flashing and trim installation and recommended by flashing manufacturer.

B. Fasteners:
   1. Wood screws, annular threaded nails, self-tapping screws, self-locking rivets and bolts, and other suitable fasteners designed to withstand design loads and recommended by flashing manufacturer.
   2. Blind fasteners or self drilling screws, gasketed, with hex-washer head.
   3. Exposed Fasteners: Heads matching color of sheet metal using plastic caps or factory-applied coating.
   4. Blind Fasteners: High strength aluminum or stainless steel rivets suitable for metal being fastened.
   5. Spikes and Ferrules: Same material as gutter; with spike with ferrule matching internal gutter width.
   6. Fastener Materials:
      a. Fasteners for Galvanized Steel Sheet: Series 300 stainless steel or hot-dip galvanized steel according to ASTM A153 or ASTM F2329.

C. Cleats:
   1. 16 GA galvanized or stainless steel.

D. Dissimilar metal and cementitious materials protection:
   1. Alkali resistant bituminous paint.
   2. Tnemec Tneme Tar 46-413.

E. Base Flashing:
   1. Fabricate to size and profile indicated.

F. Counterflashing and Flashing Reglets:
   1. Fabricate to size and profile indicated.
   2. Provide interior and exterior preformed corners as required.
   3. Fabricate as required to fit special conditions.

G. Expansion joint cover, roofing:
   1. Flexible, insulated bellows.
   2. 36 mil thick chlorinated polyethylene sheet permanently anchored between and sealed to stainless steel flanges of design required, in maximum available lengths; insulated with 3/8 IN thick closed cell foam.
   3. Corners and intersections: Manufacturer’s standard prefabricated units.
   4. Splicing strips and adhesives: Manufacturer’s standard neoprene splicing strips and adhesives.

H. Sealants: Specified in Section 07 92 13.

2.5 FABRICATION

A. General:
   1. Fabricate true and sharp to profiles and sizes indicated.
   2. Custom fabricate sheet metal flashing and trim to comply with recommendations in SMACNA Architectural Sheet Metal Manual, that apply to design, dimensions, geometry, metal thickness, and other characteristics of item indicated.
   3. Shop fabricate items to greatest extent possible.
   4. Fabricate sheet metal flashing and trim in thickness or weight needed to comply with performance requirements, but not less than that specified for each application and metal.

5. Form sheet metal flashing and trim without oil canning, buckling, and tool marks, true to line and level indicated, with exposed edges folded back to form hems.
6. Conceal fasteners and expansion provisions where possible. Exposed fasteners not allowed on faces exposed to view.

B. Fabrication Tolerances:
1. Fabricate sheet metal flashing and trim to tolerance of 1/4 IN per 20 FT on slope and location lines as indicated and within 1/8 IN offset of adjoining faces and alignment of matching profiles.

C. Sealed Joints: Form movable joints in metal to accommodate elastomeric sealant.

D. Expansion Provisions: Where lapped expansion provisions cannot be used, form expansion joints of intermeshing hooked flanges, not less than 1 IN deep. Fill with butyl sealant concealed within joints.

E. Fabricate cleats and attachment devices from same material as accessory being anchored or from compatible, noncorrosive metal.

F. Fabricate cleats and attachment devices of sizes as recommended by SMACNA Architectural Sheet Metal Manual for application, but not less than thickness of metal being secured.

G. Seams in metals with painted, coated or lacquered finishes:
1. Fabricate nonmoving seams with flat-lock seams.
2. Form seams and seal with elastomeric sealant unless otherwise recommended by sealant manufacturer for intended use.

H. Do not use graphite pencils to mark metal surfaces.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Verify suitability of substrates to accept work.
1. Verify continuous wood blocking sloped 1:12, and covered with one layer of building paper or roofing membrane.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

A. Fabricate and install in accordance with details and recommendations of SMACNA, current edition.

B. Set shop fabricated interior and exterior preformed corners and intersections.

C. Set top edges of flashings into reglets as indicated.

D. Fasten materials at recommended intervals.

E. Provide slip joints to allow for thermal movement.
1. Use SMACNA Table 3-1, Design J9 - J12, with caulked lap.
2. Maximum spacing: 10 FT on center.
3. Provide slip joint in conjunction with splices and corners.

F. Caulk joints with 2 beads of sealant on each overlap: See Section 07 92 13.

G. Turn down cap flashing over base flashings 4 IN and caulk.

H. Form flashings to provide spring action with exposed edges hemmed or folded to create tight junctures.

I. Provide dissimilar metals and materials protection where dissimilar metals come in contact, or where sheet metal contacts mortar or concrete.

J. Provide miscellaneous sheet metal items not specifically covered elsewhere, as indicated or required to provide a weathertight installation.

K. Provide continuous cleats.

3.3 INSTALLATION – GUTTERS AND DOWNSPOUTS

A. Install gutters below slope line of roof, supported on adjustable hangers spaced maximum 30 IN on center or by continuous cleats.

B. Join gutter sections with flat locked, riveted and sealed joints with hard setting sealant fill.

C. Adjust gutters to slope uniformly to downspout outlets, with high point midway between outlets.

D. Install downspouts supported by leader straps or concealed rack and pin type fasteners at top, bottom and intermediate points not exceeding 5 FT on center.

E. Install downspout 1 IN clear of building wall.

3.4 INSTALLATION – FORMED COPINGS AND FORMED ROOF EDGES

A. Prefabricated corner sections with no joint within 30 IN of corners.

B. Space gutter bars and anchor bolts as recommended by coping manufacturer for installation indicated.

C. Conceal joints with cover plates and top of adjacent wall counter flashing under coping leg.

3.5 INSTALLATION - ROOFING EXPANSION JOINT COVERS

A. Comply with manufacturer’s instructions for handling and installation of elastic expansion joint materials.

B. Coordinate installation and associated work to provide a complete system complying with recommendations of manufacturer and installer.

C. Extend over curbs, parapets, gutters, valleys, fascias and other elements in construction, to provide continuous, uninterrupted, watertight expansion joint.

D. Provide uniform hump throughout length of installation.

E. Do not stretch elastic sheet.

F. Anchor edges of units and seal in compliance with manufacturer’s instructions.

3.6 CLEAN-UP

A. Upon completion of work, repair damaged areas.

B. Repair finish of PVDF coated flashing which fades or is damaged.

C. Clean stains and debris.

D. Remove protective coverings.

END OF SECTION

SECTION 07 81 16
FIREPROOFING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Fireproofing, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM E605 Standard Test Methods for Thickness and Density of Spray Fire-Resistive Material (SFRM) Applied to Structural Members
   2. ASTM E736 Cohesion/Adhesion of Spray Fire-Resistive Material (SFRM) Applied to Structural Members

B. Underwriters Laboratories (UL):
   1. Fire resistance ratings for assemblies: UL Fire Resistance Directory.
   2. Fire resistance ratings for materials: UL Building Materials Directory.

C. Building Construction Parameters:
   1. Comply with following as locally adopted and amended:
      a. International Building Code (IBC).
      b. Year: 2006.
      c. Building Use and Occupancy Classification: Group A3.
      d. Construction Type: IA.

D. Minimum hourly fire resistance of building structural elements as defined by Building Code:
   1. Primary structural frame: 3 HR.
   2. Primary structural frame supporting roof only: 2 HR.
   3. Floor deck and secondary structural members: 2 HR.

E. Determine where fireproofing is required to provide fire resistance protection of structural elements indicated by tabular values above.
   1. At slab depressions, including regions sloped-to-drain:
      a. Increase thickness as required to compensate for reduced overall slab thickness.
      b. Extend 2 FT beyond perimeter of depressed region.

F. Apply only when ambient temperatures are above 40 DegF and will remain so during curing period.
   1. Where temporary protection and heat is provided:
      a. Maintain ambient temperatures at or above level indicated for 24 hours; before, during and for 24 hours after application.

G. Ventilate spaces during and after application of spray applied fireproofing by natural means or forced-air circulation until fireproofing material dries thoroughly.

H. Provide services of manufacturer's field service representative prior to, and during application for purposes of:
   1. Checking surfaces which fireproofing is to be applied for proper preparation.
   2. Provide instructions and technical assistance.

I. Do not install fireproofing until structure is sufficiently enclosed and roofing is installed to prevent damage to material.

J. Coordination:
   1. Sequence and coordinate application of spray applied fireproofing with other construction operations to comply with following requirements:
      a. Provide temporary enclosures to confine spraying operations and to protect environment, and to prevent deterioration of fireproofing material due to exposure to weather or unfavorable ambient conditions of humidity, temperature or ventilation.
   2. Avoid exposure of fireproofing material to abrasion and other damage caused by construction operations after application.
   3. Do not apply concealed fireproofing until clips, hangers, supports, sleeves and other items penetrating fire protection are in place.
   4. Do not install ducts, piping and other items that would interfere with application of spray applied fireproofing until application is complete and approved by field testing.
   5. Do not install enclosing or concealing construction until spray applied fireproofing has been installed, inspected and tested, and corrections have been made to defective applications.

K. Upon completion of project, manufacturer's representative to certify fireproofing system is properly installed in accordance with design requirements and manufacturer's instructions.

1.3 SUBMITTALS

A. Product Data:
   1. Data indicating physical properties of proposed products.

B. Project Information:
   1. Test reports.
   2. Detailed plans of sprayed fireproofing, or schedule of sprayed fireproofing, identifying project specific structural elements, floors and roofs.
      a. Select UL designs and prepare under direction of fireproofing manufacturer, indicating physical properties of proposed products including:
         1) Complete UL design data for each system selected.
         2) Thickness of sprayed fireproofing for specific structural elements.
         3) Densities of sprayed fireproofing and where used.

C. Contract Closeout Information:
   1. Letter of Certification.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fireproofing – Performance Based:
   1. Base:
      a. Grace Construction Products
   2. Optional:
      a. Carboline Company
      b. Isolatek International
      c. Promat Firetemp

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN CRITERIA

A. Select UL approved fireproofing assemblies which meet or exceed the hourly fire resistive requirements indicated by table in Part 1.
   1. For each density classification: Utilize materials that comply with Minimum Physical Properties indicated by table in Part 2.
   2. Utilize formulations with minimum density classification according to location and exposure condition indicated by table in Part 3.

B. Restraint classification of structural members: Restrained or unrestrained as defined by ASTM E119 Standard Test Methods for Fire Tests of Building Construction and Materials

C. Utilize fireproofing systems which have been tested for use in proposed manner.

D. Where steel bar joists are used fireproofing thicknesses shall be based on UL floor or roof test assemblies tested in fully loaded condition, with maximum allowable tensile stress of joist equaling 30 KSI.

2.3 MATERIALS

A. General:
1. Reference Part 1 for hourly fire resistance requirements of various structural elements on project.
2. Reference Part 3 for locations or conditions which may require densities listed in following Table.
   a. Some density classifications may not be applicable to project.

B. Provide products containing no detectable asbestos as determined in accordance with method specified in 40 CRF 763, Subpart E, Appendix E, Section 1, and Polarized Light Microscopy.
1. Free from forms of asbestos, including actinolite, amosite, anthophyllite, chrysotile, crocidolite and tremolite.

C. Comply with following minimum properties:

Minimum Physical Properties by Density Classification

Property	Test Method	Standard Density	Medium Density	High Density
Binder Type	--	Gypsum or Portland Cement	Portland Cement [1]	Portland Cement
Dry Density	ASTM E605	15 PCF	22 PCF	40 PCF
Bond Strength	ASTM E736	150 PSF	430 PSF	1000 PSF
Compression (at 10 percent Deformation)	ASTM E761	750 PSF	7,344 PSF	43,200 PSF
Maximum Air Erosion	ASTM E859	0.025 G/FT2 (Category A)	0.025 G/FT2 (Category A)	0.025 G/FT2 (Category A)
Corrosion	ASTM E937	Does not contribute	Does not contribute	Does not contribute
Bond Impact	ASTM E760	No cracking, spalling or delamination	No cracking, spalling or delamination	No cracking, spalling or delamination
Deflection	ASTM E759			
Resistance to Mold Growth	ASTM G21	No growth after 28 days	No growth	No growth
Combustibility	ASTM E136	< 5 MJ/M^2	< 5 MJ/M^2	< 5 MJ/M^2
Flame Spread	ASTM E84	< 25 (Class A)	< 25 (Class A)	< 25 (Class A)
Smoke Developed	ASTM E84	< 450 (Class A)	< 450 (Class A)	< 450 (Class A)

Footnotes:

1. Gypsum-based products may be substituted where prolonged exposure to water is unlikely.

D. Base Products:
1. Standard Density: Monokote MK-6 or MK-6/HY or both by Grace Construction Products.
2. Medium Density:
   a. For use in potentially wet areas: Monokote Z-106/HY by Grace Construction Products.
   b. For use in non-wet areas: Monokote Z-106/G by Grace Construction Products.
3. High Density: Monokote Z-146 by Grace Construction Products.

E. Fibrous Products:
   a. Fibrous spray-applied fire-resistive products will not be permitted on project.

2.4 AUXILIARY MATERIALS

A. General:
   1. Provide auxiliary fire resistive materials that are compatible with spray applied cementitious fireproofing and substrates, and are approved by UL for use in approved UL design designations.

B. Adhesive:
   1. As required for bonding spray applied fireproofing.
   2. Products as approved by fireproofing manufacturer.

C. Metal Lath:
   1. Expanded metal lath fabricated from material, weight, configuration and finish required to comply with approved UL design designations and fireproofing manufacturer's written recommendations.
   2. Include clips, lathing accessories, corner beads and other anchoring devices required to attach lath to substrates and to receive spray applied fireproofing.

D. Water:
   1. Potable.

E. Auxiliary Materials for used with Cellular Metal Decking:
   1. Include manufacturer's standard spatter coat or primer where required by UL Design or where recommended by manufacturer for optimal bond to substrate types; i.e., cellular decking.
      a. Utilize product specifically formulated for use with cellular decking.

F. Fungicidal Additive:
   1. Include fungicide additive containing sodium propionate, or another approved fungus inhibitor as necessary to comply with Minimum Physical Properties and ASTM-G21.
   2. Mix with fireproofing mixture before application.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrates to accept application.

B. Application constitutes acceptance of conditions and responsibility for performance.

3.2 PREPARATION

A. Clean off materials which impair bond from surfaces to be fireproofed.

B. Mark location of hangers, inserts, straps, anchors, supports, and similar items by other trades that may be concealed by fireproofing to permit locating after fireproofing is applied.

C. Schedule installation to allow time for installation of hangers, inserts, straps, anchorages, supports, and similar items by other trades.

D. Prepare substrates, areas, and conditions for compliance with requirements affecting performance of work.
   1. Substrates shall be free of oil, grease, rolling compounds, incompatible primers, loose mill scale, soil and other foreign substances capable of impairing bond of fireproofing under conditions of normal use or fire exposure.
   2. Objects penetrating fire resistive material, including clips, hangers, supports, sleeves and similar items, shall be securely attached to substrates.
   3. Substrates shall not be obstructed by ducts, piping, equipment and other suspended construction that will interfere with application of spray applied fireproofing.

E. Conduct tests in accordance with fireproofing manufacturer's written recommendations to verify substrates are free of substances capable of interfering with bond.

1. Correct unsatisfactory conditions.
2. Start of application constitutes acceptance of conditions and responsibility for performance.

F. Cover other work subject to damage from fallout or overspray of fireproofing during application.

G. For exposed fireproofing applications, repair substrates to remove surface imperfections that could affect uniformity of texture and thickness in finished surface of spray-applied fireproofing.
1. Remove minor projections.
2. Fill voids that would telegraph through fireproofing after application.

3.3 INSTALLATION

A. General:
1. Install fireproofing of density types listed in this section for exposure locations and that provide fire resistance ratings indicated for components and assemblies.
2. Thickness: Minimum average thickness indicated for UL design designation, but not less than 3/8 IN.
3. Apply in accordance with manufacturer and UL requirements.
4. Provide preparation, primers, adhesives, materials, taping and sealers necessary to provide required fire resistance ratings.
5. Comply with fireproofing manufacturer's written instructions for mixing materials, application procedures, and types of equipment used to mix, convey and spray on fireproofing material, as applicable to particular conditions of installation and as required to achieve fire resistance ratings indicated.
   a. Apply spray applied fireproofing materials that are identical to products tested and substantiated by test reports with respect to rate of application, accelerator use, sealers, topcoats, tamping, troweling, rolling and water overspray.

B. Where required to achieve fire resistance rating or rating recommended in writing by fireproofing manufacturer, coat metal deck substrates with adhesive before applying fireproofing material.

C. Extend fire resistive material in full thickness over entire area of each substrate to be protected.
1. Install body of fire resistive covering in single course, unless otherwise recommended in writing by SFRM manufacturer,

D. Connections of Dissimilar Structural Elements:
1. Definition: Where structural elements are joined to other, often different type, of structural elements having a lesser SFRM protection requirement.
2. Overlap the lesser priority structural element with superior SFRM thickness required by the higher priority element.
3. Minimum Width of Overlap: As required in design system published by UL or similar testing agency, but not less than 6 IN.

E. Install metal lath if required to comply with fire resistance ratings or fireproofing manufacturer's written recommendations for conditions of exposure and intended use.
1. Securely attach lath to substrate in position required for support and reinforcement of fireproofing material.
2. Use anchorage devices of type recommended in writing by fireproofing manufacturer.
3. Attach lathing accessories where required for secure attachment to substrate.

F. Spray apply fireproofing to maximum extent possible.
1. Apply fireproofing in thicknesses and densities not less than required for fire resistance ratings for each condition; however, apply in greater thicknesses and densities if indicated.
2. Following the spraying operations in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
3. Where sealers are used, apply products tinted for differentiation from spray applied fireproofing.

G. Exposed Fireproofing:
1. Apply fireproofing in thicknesses and densities not less than required for fire resistance ratings for each condition, or apply in greater thicknesses and densities indicated.

2. Finish:
   a. Following the spraying operations in each area, complete the coverage by trowel application or other placement method recommended in writing by fireproofing manufacturer.
   b. In addition, provide uniform even spray textured finish up to 8 FT above finished floor.
   c. Roll flat surfaces with damp paint roller to remove drippings and excessive roughness of applied exposed fireproofing.
      1) Provide rolled flat fireproofing surfaces in mechanical rooms, elevator machine rooms, emergency generator rooms, electrical switchgear rooms, and rooms containing similar equipment items.
   d. Exposed fireproofing higher than 8 FT above finished floor is not required to have rolled flat surface finish using paint roller.

H. Cure exposed fireproofing in accordance with manufacturer's written recommendations to prevent premature drying.

I. Fireproof accessory items such as but not limited to X-bracing, struts, outriggers, and similar items.

J. At elevated slab depressions, including regions sloped to drain:
   1. Apply additional fireproofing as required to compensate for reduced overall floor slab thickness.
   2. Extend 2 FT beyond perimeter of depressed region.

3.4 SCHEDULE OF DENSITIES REQUIRED BY EXPOSURE CONDITIONS

A. Determine appropriate density required for project conditions based on following:
   1. Some conditions may not apply to subject project.

Minimum Density Required for Location/Exposure Condition					
Location/Exposure Condition of Structural Members			Minimum Density Required		
				Medium Density	High Density
Interior	Concealed	Members that are fully concealed behind permanent Wall or Soffit Construction. Refer to Exposed if any portion of a member is not concealed.	S		
Interior	Exposed	Members that are entirely above ordinary (non-walkable) Suspended Ceilings.	S [1,2]		
Interior	Exposed	Members where any exposed portion occurs within Air Shafts or Air Plenum Space.		M [1]	
Interior	Exposed	Members where any exposed portion occurs within 8 FT of Floors, Stair Landings, Treads or similar walking surface.		M [1]	
Interior	Exposed	Members in Mechanical Rooms and Storage Rooms where any portion is exposed.			H
Exterior	Exposed	Members that are exposed to weather (permanently).			H

General Notes:
Use above Table to select appropriate minimum density, based on the Location/Exposure criteria which best describes the condition. It is acceptable to provide material of a higher density.
Where a member or various portions of a member fits multiple Location/Exposure categories, select highest density product from among potential choices and apply to entire member.
Refer to Part 2 for minimum properties of each density classification.
Refer to Part 1 for hourly fire resistance requirements of various structural elements on this project.

Footnotes:
1. Ensure the use of Portland Cement-based formulas where prolonged exposure to water or humidity greater than 70 percent RH is likely.
2. Upgrade to Medium where above-ceiling space is designed as an Air Plenum.

3.5 FIELD QUALITY CONTROL

A. General:
   1. Thickness and density testing:
      a. Test Standard: ASTM E605 Thickness and Density of Spray Fire Resistive Materials (SFRM) Applied to Structural Members.
      b. Minimum Test Frequency: In accordance with building Code, as locally adopted; however, not less than frequency prescribed by ASTM E605.
   2. Bond adhesion and cohesion testing:
      a. Test Standard:
         1) ASTM E736 Cohesion and Adhesion of Spray Fire Resistive Materials (SFRM's) Applied to Structural Members.
      b. Minimum Test Frequency:
         1) In accordance with building Code, as locally adopted; however, not less than frequency prescribed by ASTM E736.

B. Testing Paid by Owner:
   1. Contractor provide fireproofing systems schedule, prepared by spray fireproofing manufacturer, to independent testing laboratory.
   2. Contractor arrange with independent testing laboratory to take samples and perform required tests.
      a. Contact laboratory, solicit proposals, and provide additional information about laboratory Owner requires.
      b. Provide information to Owner for review.
      c. Obtain written Owner approval of selected laboratory.
      d. If laboratory is unacceptable, investigate others until Owner accepts a testing laboratory.
   3. Test in field, per ASTM standards indicated to ensure conformance with applicable building Code and UL requirements for thickness, density and bond strength.
      a. Should test fail, take additional tests until extent of defective area has been determined.
      b. Repair or remove and replace defective material and retest until requirements are met.
      c. Cost of initial tests paid by Owner.
      d. Retesting due to test failure paid by Contractor.

3.6 CLEANING, PROTECTION AND REPAIR

A. Cleaning:
   1. Immediately after completing fireproofing in each containable area, remove material overspray and fallout from surfaces of other construction.
   2. Clean exposed surfaces to remove soiling.

B. Protection:
   1. Protect fireproofing from damage or deterioration resulting from construction operations.
   2. Coordinate application of fireproofing with other construction to minimize need to cut or remove fireproofing.

C. Repair:
   1. Patch, repair and restore fireproofing to complete UL required where areas of fireproofing is damaged.

END OF SECTION

SECTION 07 84 00
FIRESTOPPING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Firestopping, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Certified, licensed or approved by firestopping manufacturer, trained to install firestop products per specified requirements.
   2. Licensed by State or local authority, where applicable.
   3. Shown to have successfully completed not less than five (5) comparable scale projects.

B. Provide firestop systems in compliance with following requirements:
   1. Obtain firestop system for each type of penetration and construction condition from a single firestop systems manufacturer.
   2. Firestop products and systems shall bear classification marking of qualified testing and inspection agency.
   3. Firestopping tests, performed by qualified, testing and inspection agency.
      a. UL or other agency, performing testing and follow-up inspection services for firestop systems, acceptable to local authorities having jurisdiction.
   4. Existing applications for which no tested and listed classified system is available through a manufacturer:
      a. Provide Engineering Judgment or Equivalent Fire Resistance Rated Assembly (EFRRA) for submittal derived from similar UL system designs or other tests approved by local authorities having jurisdiction, prior to installation.
      b. Engineering judgment drawings must follow requirements set forth by International Firestop Council.
   5. Inspect applied firestopping systems in accordance with International Building Code (IBC) Chapter 17.
      a. Inspections shall be performed by an FMG 4991 Approved Specialty Contractor/UL Qualified Firestop Contractor and/or ASTM E2174 and ASTM E2393.
      b. See Section 01 45 23.

C. Underwriters Laboratories, Inc. (UL):
   1. UL 263, Fire Tests of Building Construction and Materials
   2. UL 723, Surface Burning Characteristics of Building Materials
   3. UL 1479, Fire Tests of Through Penetration Firestops
   4. UL 2079, Tests for Fire Resistance of Building Joint Systems

D. ASTM International (ASTM):
   1. ASTM E84 Surface Burning Characteristics of Building Materials
   2. ASTM E119 Fire Tests of Building Construction and Materials
   3. ASTM E136 Test Method for Behavior of Materials in a Vertical Tube Furnace at 750F
   4. ASTM E814 Fire Tests of Through Penetration Fire Stops
   5. ASTM E1399 Cyclic Movement and Measuring the Minimum and Maximum Joint Widths of Architectural Joint Systems
   6. ASTM E1966 Test Method for Fire Resistive Joint Systems
   7. ASTM E2174 Standard Practice for On-site Inspection of Installed Fire Stops

8. ASTM E2307 Standard Test Method for Determining the Fire Endurance of Perimeter Fire Barrier Systems Using the Intermediate-Scale, Multi Story Test Apparatus (ISMA)
9. ASTM E2393 Standard Practice for On-site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers

E. Building Code as locally adopted and amended.

F. Underwriters Laboratories (UL) Fire Resistance Directory:
1. Through Penetration Firestop Systems (XHEZ).
2. Joint Systems (XHBN).
3. Fill, Void or Cavity Materials (XHHW).
4. Firestop Devices (XHJI).
5. Forming Materials (XHKU).
6. Wall Opening Protective Materials (CLIV).

G. National Fire Protection Association (NFPA):
1. NFPA 70: National Electrical Code
2. NFPA 101: Life Safety Code
3. NFPA 22: Standard for High Challenge Fire Walls, Fire Walls, and Fire Barrier Walls
4. NFPA 251: Fire Tests of Building Construction and Materials

H. Firestop Contractors International Association (FCIA):
1. MOP – FCIA Firestop Manual of Practice

I. International Firestop Council (IFC):
1. Recommended IFC Guidelines for Evaluating Firestop Engineering Judgments, latest revision.
2. Inspectors Field Pocket Guide, latest edition.

J. Identification Labels for Firestop Assemblies:
1. Follow guidelines set in Chapter 7 of International Building Code.
2. Coordinate with Section 04 22 00 and Section 09 29 00.

K. Pipe insulation shall not be removed, cut away or otherwise interrupted through wall or floor openings.
1. Provide products appropriately tested for the thickness and type of insulation utilized.

L. Cabling where frequent cable moves, add-ons, and changes are likely to occur in future:
1. Where cable trays are used:
   a. Utilize re-enterable products (e.g. removable intumescent pillows) specifically designed for retrofit.
2. Where cable trays are not used:
   a. Utilize fire-rated cable pathway devices.
   b. Where not practical, re-enterable products designed for retrofit may be used.

M. Protect penetrations passing through fire-resistance rated floor-ceiling assemblies contained within chase wall assemblies with products tested by being fully exposed to fire outside of chase wall.
1. Identify systems within UL Fire Resistance Directory with the words: Chase Wall Optional.

N. Fire Resistive Joint Sealant:
1. Provide flexible fire-resistive joint sealants to accommodate normal and thermal building movement without seal damage.
2. Provide fire-resistive joint sealants designed to accommodate a specific range of movement.
   a. Test in accordance with cyclic movement test criteria as outlined in: ASTM E1399, ASTM E1966 or UL 2079.
3. Provide fire-resistive joint systems subjected to an air leakage test.
   a. Conduct in accordance with UL 2079, with published L-Ratings for ambient and elevated temperatures, as evidence of ability of fire-resistive joint system to restrict movement of smoke.

4. Coordinate firestopping with acoustical sealant requirements in Section 07 92 16.

O. Subject smoke wall containment systems to air leakage test.
   1. Conduct in accordance with UL 1479, with published L-Ratings for ambient and elevated temperatures, as evidence of ability of fire-resistive joint system to restrict movement of smoke.

P. System Description:
   1. Through Penetration Firestop Systems for protection of penetrations through following fire-resistance rated assemblies, including both blank openings and openings containing penetrating items:
      a. Roof assemblies.
      b. Floor assemblies.
      c. Wall and partition assemblies.
      d. Fire-rated smoke barrier assemblies.
      e. Existing, fire and smoke-rated assemblies.
      f. Construction enclosing compartmentalized areas.
   2. Fire Resistive Joint Assemblies for linear voids where fire-rated floor, roof, or wall assemblies abut one another, including following types of joints:
      a. Top and bottom of wall interface with overhead roof or floor structure:
         1) Coordinate with acoustical sealant specified in Section 09 29 00.
         2) Select products to maintain acoustical, smoke and fire ratings indicated.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's standard information indicating certification of products proposed for use on project.

B. Project Information:
   1. UL reports with illustration of systems, system numbers, temperature ratings, and products proposed for use on project.

C. Contract Closeout Information:
   1. Warranty.
   2. Electronic file of project firestopping documentation.

1.4 WARRANTY

A. Written five (5) year warranty guaranteeing quality of installation and meeting requirements of manufacturer's written instructions and tested systems.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Firestopping:
   1. Base:
      a. Hilti Inc.
   2. Optional:
      a. 3M
      b. Rectorseal
      c. Specified Technologies, Inc.
      d. Tremco, Inc.
      e. United States Gypsum Company
      f. W.R. Grace & Company

B. Forming Materials:
   1. Base:
      a. Hilti, Inc.
   2. Optional:
      a. Industrial Insulation Group.
      b. Rock Wool Manufacturing
      c. Roxul Inc.
      d. Thermafiber

C. Other manufacturers desiring approval, comply with Section 00 26 00.
   1. See systems Volume 2 of UL Building Materials Directory.

2.2 MATERIALS

A. Through Penetration Firestop Systems:
   1. VOC content not to exceed 250 g/L
   2. Base Products:
      a. FS-ONE Intumescent Firestop Sealant.
      b. CP 604 Self-leveling Firestop Sealant.
      c. CP 620 Fire Foam.
      d. CP 606 Flexible Firestop Sealant.
      e. CP 601S Elastomeric Firestop Sealant.

B. Fire-resistive Joints:
   1. VOC content not to exceed 250 g/L
   2. Base Products:
      a. CFS-SP WB Firestop Joint Spray.
      b. CP 601S Elastomeric Firestop Sealant.
      c. CP 606 Flexible Firestop Sealant.
      d. CP 604 Self-leveling Firestop Sealant.

C. Intumescent Joints:
   1. For use at top of wall application.
   2. Base Product:
      a. Speedflex by Specified Technologies, Inc.

D. Firestop Devices:
   1. Factory-assembled collars lined with intumescent material sized to fit specific outside diameter of penetrating item.
   2. Base Products:
      a. CP 680-P Cast-in-Place Firestop Device.
      b. CP 680-M Cast-in-Place Firestop Device.
      c. CP 681 Tub Box Kit.
      d. CFS-DID Firestop Device.

E. Intumescent Pads, Wall Opening Protective Materials:
   1. Intumescent, non-curing pads or inserts for protection of electrical panels, switch and receptacle boxes, medical gas outlets and valve boxes and other items recessed in face of fire rated walls.
   2. Base Product:
      a. CFS-P PA Firestop Putty Pad.
      b. CP 617 Firestop Putty Pad.
      c. Hilti Biox Insert.

F. Fire-rated Cable Pathways:
   1. Usage:
      a. Cables passing through fire-rated floors or walls shall pass through fire-rated cable pathway devices made from an intumescent material that adjusts automatically to cable additions or subtractions.

2. Product description and requirements:
    a. Pathway device modules comprised of steel raceway and intumescent pads with adjustable smoke seal sleeve.
    b. F-Rating equal to the rating of barrier the device penetrates.
    c. Pathway devices shall be capable of allowing a 0 to 100 percent fill of cables.
    d. Size to accommodate quantity and size of electrical wires and data cables indicated plus 100 percent expansion.
    e. Provide wire devices with steel wall plates allowing for single or multiple devices ganged together without requiring additional wall structure framing.
3. Base product:
    a. CP 653 Speed Sleeve.
        1) Use in conjunction with CFS-SL GP when more than one device is required.
    b. CFS-CC Firestop Cable Collar.

G. Firestop Putty:
1. Intumescent, non-hardening, water resistant putties containing no solvents, inorganic fibers or silicone compounds.
2. Firestop putty shall be provided and installed at, but not limited to, the gap between wire, cabling, or both, exiting an open end of conduit, where conduit penetrates one or both sides of a smoke or fire rated wall assembly.
3. Base products:
    a. CP 618 Firestop Putty Stick.
    b. CFS-PL Firestop Plug.

H. Wrap Strips:
1. Single component intumescent elastomeric strips faced on both sides with a plastic film:
2. Base Products:
    a. CP 643N Firestop Collar.
    b. CP 644 Firestop Collar.
    c. CP 648E/648S Wrap Strips.

I. Firestop Blocks:
1. Re-enterable, non-curing, intumescent flexible block.
2. Base products:
    a. CFS-BL Fire Block.
    b. CFS-PL Firestop Plug.

J. Mortar:
1. Portland cement based dry-mix product formulated for mixing with water at Project site to form a non-shrinking, water-resistant, homogenous mortar.
2. Base product:
    a. CP 637 Firestop Mortar.

K. Silicone Sealants:
1. Moisture curing, single component, silicone elastomeric sealant for horizontal surfaces pourable or nonsag or vertical surface nonsag.
2. Base product:
    a. CP 601S Elastomeric Firestop Sealant.
    b. CP 604 Self LevelingSilicone Firestop Sealant.
    c. CFS-SIL SL Self Leveling Silicone Firestop Sealant.

L. Pre-formed mineral wool:
1. CP 767 Speed Strips
2. CP 777 Speed Plugs

M. Fire Sealant:
1. Single component latex or acrylic formulations that upon cure do not re-emulsify during exposure to moisture.
    a. CP 601S Elastic Firestop Sealant.

b. CP 606 Fire Resistant Joint Filler.
c. CP 672 Firestop Joint Spray.
d. CFS-SP WB Firestop Joint Spray.

N. Composite Sheet:
1. Non-curing, re-penetrable material.
2. Base Products:
a. CP 675T Firestop Board.
b. CFS-BL FireBlock.

O. Forming Materials:
1. Materials listed as components in laboratory-approved designs.
2. Mineral Wool:
a. Base Product:SAF by Thermafiber, or
b. Similar product specifically named as components in laboratory-approved designs.

2.3 THROUGH PENETRATION FIRESTOP SYSTEMS

A. General:
1. Schedules below identify requirements for acceptable through penetration firestop systems based on barrier type, fire-resistive rating, and penetrant type. Each system must comply with building code and fire code as locally adopted and amended.
2. Requirements for single-membrane penetrations and through penetration firestops are identical. Unless otherwise noted, penetrants which pass through a single membrane, shall be treated the same as if it passed through the entire fire-resistive assembly.
3. Select each firestop system based on actual field conditions, including penetration type, shape, size, quantities and physical position within opening.
4. Refer to Plans for indication of the required ratings of fire-resistive wall, floor, and roof assemblies.
5. Indicated ratings are minimum and may be exceeded.
6. Firestop Assemblies at Fire-Rated Walls:
a. The minimum Fire (F) Rating for Firestop assemblies in walls shall equal that of the wall, but not less than 1-HR.
b. The minimum Temperature (T) Rating of Firestop assemblies in walls may equal zero.
c. Smoke Barrier: In addition to (F) Rating, (L) Rating of maximum 5 CFM per SF.
d. Non-rated walls and Smoke-Partitions with no fire-resistive requirement: Assembly with (L) rating.
7. Firestop assemblies at fire-rated floors and roofs:
a. Minimum Fire (F) and Temperature (T) Ratings of Firestop assemblies used in floors or roof shall equal hourly rating of floor or roof being penetrated, but not less than 1-HR.
1) Exception 1: The T-rating may equal zero when portion of penetration, above or below floor, is contained within a wall.
2) Exception 2: Firestops are not required for floor penetrations within a 2-hour rated shaft enclosure.

B. Voids in wall with no penetrations:
1. Fill with approved through penetration firestopping system.
2. Contractor’s option: Patch void in wall with like construction.

C. Penetrating Ducts with Dampers:
1. Utilize only firestop materials which are included in damper’s classification.
2. Do not install firestop systems that hamper performance of fire dampers.

D. Cable Trays and similar devices:
1. Provide re-enterable products specifically designed for removal and re-installation at openings within walls and floors designed to accommodate voice, data and video cabling.

E. Electrical panels and devices, medical gas outlets and valve boxes, film illuminators, and other items recessed in to face of rated walls:

1. Where electrical devices are placed on opposite sides of wall, and are less than 24 IN apart measured horizontally, install intumescent pads over back of devices in approved manner or maintain continuity of rated barrier within wall cavity surrounding recessed item.

2.4 FIRE-RESISTIVE JOINT ASSEMBLIES – GENERAL

A. General:
   1. Where joint will be exposed to elements, fire-resistive joint sealant must be approved by manufacturer for use in exterior applications and shall comply with ASTM C920.

B. Head-of-Wall Assemblies:
   1. General:
      a. Use at top of fire-rated and smoke barrier walls and partitions where they abut floor and roof structures above.
      b. Select systems with D designation, rated for dynamic movement capability.
      c. Select systems that can accommodate deflection of structure above.
      d. Maximum Leakage for Fire-resistive Joints in Smoke Barriers: 5 CFM or less per linear foot as tested in accordance with UL 2079.
      e. Seal non-fire-rated sound-control walls and smoke partitions with acoustical sealant as specified in Section 07 92 16.
   2. Minimum F and T ratings:
      a. The minimum fire rating for firestop assemblies in walls shall equal that of wall, but not less than 1-HR.
      b. The minimum temperature rating of firestop assemblies in walls may equal zero.
   3. Acceptable Systems:
      a. Metal stud and drywall partitions: Select system from UL HW-D-0000 Series.
      b. Concrete and Masonry Walls: Select system from UL HW-D-1000 Series.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine areas and conditions under which work is to be performed and identify conditions detrimental to proper or timely completion.

B. Surfaces to which firestop materials will be applied shall be free of dirt, grease, oil, scale, laitance, rust, release agents, water repellents, and any other substances that may inhibit optimum adhesion.

C. Provide masking and temporary covering to prevent soiling of adjacent surfaces by firestopping materials.

D. Do not proceed until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General:
   1. Install firestop systems in accordance with manufacturer's instructions and conditions of testing and classification as specified in UL or other acceptable third-party testing agency listing.
   2. Penetrations through fire-resistive floor assemblies shall be sealed with firestop system providing minimum Class 1 W-rating as tested in accordance with UL 1479 and ensure air and water resistant seal.
   3. Protect materials from damage on surfaces subjected to traffic.

B. Identification Labels:
   1. Identify each firestop assembly as defined in Quality Assurance.
   2. Do not locate identification labels, tags, or both, on finished surfaces or where exposed to view by public.

3.3 FIELD QUALITY CONTROL

A. Maintain areas of work accessible until inspection by authorities having jurisdiction.

B. Where deficiencies are found, repair or replace assemblies to comply with requirements.

3.4 ADJUSTING AND CLEANING

A. Remove equipment, materials and debris, leaving area in undamaged, clean condition.

B. Clean surfaces adjacent to sealed openings free of excess materials and soiling as work progresses.

C. Perform patching and repair of firestopping systems damaged by other trades.

END OF SECTION

SECTION 07 92 15
SECURITY CAULKING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Security Caulking, as indicated, in accordance with provisions of Contract Documents.

B. Section includes: caulking of joints in the detention area.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer: A firm with a minimum of 5 years experience in the application of security caulking in detention applications.

1.3 SUBMITTALS

A. Product Data: Submit copies of manufacturer's specifications, recommendations, and installation instructions.

B. Color Charts: Submit 3 sample strips of colors available for each type of sealant.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Security Sealant:
   1. Base:
      a. Tremko
      b. Sika Corp.

B. Other manufacturers desiring approval comply with Section 00 26 00.

C. Colors:
   1. Where sealant is not exposed to view, provide manufacturer's standard color that has the best overall performance characteristics for the application.
   2. Where sealant is exposed to view, provide manufacturer's standard color palette for selection by Architect.

2.2 MATERIALS

A. Security Sealant: One component polyurethane known as Low-Mod Gel or Epoxy Resin Gap Filler:
   1. Shore "a" hardness 55-60.

B. Acceptable Products:
   1. Volkem 617 by Tremko
   2. Sika-Dur 23 by Sika Corp.

C. Joint Cleaner: Provide the type of joint cleaning compound recommended by the caulking manufacturer for the joint surfaces to be cleaned.

D. Joint Primer/Sealer: Provide the type of joint primer/sealer recommended by the caulking manufacturer for the joint surfaces to be primed or sealed.

E. Sealant Backer Rod: Compressible polyethylene jacketed polyurethane foam, butyl rubber foam, neoprene foam or other flexible, permanent, durable non-absorptive material as recommended for compatibility with caulking by the caulking manufacturer. Provide size and shape which will control the joint depth for caulking placement and provide a highly compressible backer to minimize the possibility of caulking extrusion when joint is compressed.

PART 3 - EXECUTION

3.1 JOINT SURFACE PREPARATION

A. Clean joint surfaces immediately before installation of caulking. Remove dirt, coating, moisture and other substances which would interfere with bond of sealant.

B. Prime or seal the joint surfaces, wherever recommended by the caulking manufacturer.

C. Use masking tape where required to prevent contact of caulking with adjoining surfaces which otherwise would be permanently stained or damaged by such contact or by cleaning methods required to remove caulking smears. Remove tape immediately after tooling without disturbing joint seal.

3.2 INSTALLATION

A. Comply with caulking manufacturer's printed instructions, except where more stringent requirements are shown or specified and except where manufacturer's technical representative suggests otherwise.

B. Comply with recommendations of ASTM C962 for use of joint sealants as applicable to materials, applications, and conditions.

C. Install caulking backer rod, except where recommended to be omitted by caulking manufacturer for the application. Size rod to compress 25 to 50 percent and roll into joint without twisting or stretching.

D. Install bond breaker tape wherever required by manufacturer's recommendations to ensure elastomeric sealants will perform properly.

E. Use only proven installation techniques which will ensure that caulking will be deposited in uniform, continuous ribbons without gaps or air pockets. Fill and tool caulking to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and a vertical surface, fill joint to a slight cove, so that the joint will not trap moisture and dirt.

F. Install caulking to depths as recommended by the caulking manufacturer.

G. Spillage
   1. Do not allow caulking to overflow onto adjoining surfaces or to migrate into the voids of adjoining surfaces.
   2. Remove excess and spillage promptly as the Work progresses. Clean the adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage, without damage to the adjoining surfaces or finishes.

END OF SECTION

SECTION 07 92 16
INTERIOR JOINT SEALANTS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Sealants, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Definitions:
   1. Caulk and Caulking are synonymous with sealant work.
   2. Interior Wet Areas includes toilets, showers, kitchens and similar areas where sealant is subject to moisture.

B. Seal joints which permit penetration of moisture or air, unless sealant work is specifically required under other sections.

C. Provide sealants per following:
   1. Masonry control joints, and between masonry and other materials.
   2. Flooring joints.
   3. Isolation joints.
   4. Joints at penetrations of walls, floors and decks by piping and other services and equipment not requiring firestopping.
   5. Perimeters of door and window frames, louvers, grilles, etc.
   6. Between cabinets, casework, countertops and back splashes where adjacent to walls.
   7. Joints between dissimilar materials, to provide visually acceptable closures.
   8. Other joints where caulking, or sealant is indicated.

D. American Society for Testing and Materials:
   1. ASTM C510 Standard Test Method for Staining and Color Change of Single- or Multicomponent Joint Sealants
   2. ASTM C711 Standard Test Method for Low-Temperature Flexibility and Tenacity of One-Part, Elastomeric, Solvent-Release Type Sealants
   3. ASTM C719 Standard Test Method for Adhesion and Cohesion of Elastomeric Joint Sealants Under Cyclic Movement
   4. ASTM C792 Standard Test Method for Effects of Heat Aging on Weight Loss, Cracking, and Chalking of Elastomeric Sealants
   5. ASTM C793 Standard Test Method for Effects of Laboratory Accelerated Weathering on Elastomeric Joint Sealants
   6. ASTM C910 Standard Test Method for Bond and Cohesion of One-Part Elastomeric Solvent Release-Type Sealants
   7. ASTM C920 Standard Specification for Elastomeric Joint Sealants
   8. ASTM C1193 Standard Guide for Use of Joint Sealants

E. South Coast Air Quality Management District (SCAQMD), Rule #1168.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Sealant Schedule with the following information:
      a. Generally describe locations requiring sealants (i.e. GWB to Aluminum Window).
      b. List type of sealant, and name of product proposed for each location.

c. Include a blank Color Column on schedule for selection.
d. Architect to complete Color Column upon selection from submitted samples.

B. Product Data:
1. Performance characteristics and limitations.
2. Recommended installation.

C. Samples:
1. Submit cured sample of each color with Sealant Schedule.

D. Contract Closeout Information:
1. Warranty.

1.4 WARRANTY

A. Provide written warranty that sealant work will remain free of defects for a period of three (3) years from Date of Substantial Completion:
1. Failure of water or air tightness constitutes defect.
2. Loss of adhesion, cohesion or failure to cure constitutes defect.
3. Remove defective work and materials and replace with new work and materials.
4. Repair other work damaged as a result of defective sealant work at no additional expense to Owner.
5. Non- prorated warranty to include labor and material.
6. Warranty signed by Installer, Contractor, or both.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Polyurethane Sealants:
1. Base:
a. Tremco
2. Optional:
a. Pecora
b. Sonneborn/ChemRex
c. Sika
d. Bondaflex Technologies

B. Silicone Sealants:
1. Base:
a. As noted for individual items.
2. Optional:
a. Bondaflex Technologies
b. Color Rite
c. Dow Corning
d. GE Silicones
e. Pecora
f. Sonneborn/ChemRex
g. Tremco

C. Acoustical Sealant:
1. Base:
a. Hilti
2. Optional:
a. Grabber
b. Pecora
c. STI
d. 3M

D. Other Sealants:
   1. Base: As indicated.

E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
   1. ASTM C920 Type S or M, Grade-NS, minimum Class 25.
   2. Non-staining sealant complying with ASTM C510.
   3. Where sealant is not exposed to view, use manufacturer's standard color which has best performance.
   4. Use non-sag sealant in vertical joints.
   5. Use self-leveling or non-sag sealant in horizontal joints.
   6. Before use of sealant, investigate its compatibility with surfaces, fillers and other materials in joint system.

B. VOC Content of Interior Sealants:
   1. Comply with South Coast Air Quality Management District (SCAQMD), Rule 1168.
      a. Sealants: 250 g/L.
      b. Sealant Primers for Nonporous Substrates: 250 g/L.
      c. Sealant Primers for Porous Substrates: 775 g/L

C. Elastomeric Sealant:
   1. Refer to Sealant Selection Guide for types required.
   2. Comply with VOC limits as required by local laws or specified otherwise.

D. Casework Sealant:
   1. Solid Colors: Color-Sil by Color Rite; 100 percent silicone.

E. Acoustical Sealant:
   1. Flexible, non-hardening.
   2. UL listed.
   3. Seal perimeter of sound rated partitions.
   4. Seal perimeter and cover outside faces of electrical boxes and similar utilities in sound rated partitions.
   5. Base Products:
      a. Gun - CP 601S by Hilti
      b. Spray - CFS-SP WB by Hilti

F. Joint Cleaner, Primer, Bond Breaker:
   1. As recommended by sealant manufacturer.

G. Backer Rod:
   1. Polyethylene, polyethylene jacketed polyurethane foam, flexible, non-absorbent, non-bituminous material recommended by sealant manufacturer.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not proceed with installation of joint sealants under following conditions:
   1. When ambient and substrate temperature conditions are outside limits permitted by joint sealant manufacturer or are below 40 degF.
   2. When joint substrates are wet.

B. Do not proceed with installation of joint sealants where joint widths are less than those allowed by joint sealant manufacturer for applications indicated.

C. Apply only to joints free of material which may inhibit bond.

D. Apply to cementitious materials only when thoroughly cured and dry.

3.2 PREPARATION

A. Clean joints and prime as required by sealant manufacturer.

B. Install sealant after finish coating or covering is scheduled to be applied.

C. Limit application to surfaces to receive sealants and mask edges of joints to protect adjacent surfaces.

3.3 INSTALLATION

A. Install sealant backings to support sealants during application.
   1. Control joint depth.
   2. Break bond of sealant at bottom of joint.
   3. Provide proper shape of sealant.
   4. Do not leave gaps between ends of sealant backings.
   5. Do not stretch, twist, puncture, or tear sealant backings.
   6. Remove absorbent sealant backings that have become wet before sealant application and replace them with dry materials.

B. Install bond-breaker tape behind sealants where sealant backings are not used between sealants and backs of joints.

C. Install sealants using proven techniques that comply with the following and at same time backings are installed:
   1. Place sealants to directly contact and fully wet joint substrates.
   2. Completely fill recesses in each joint configuration.
   3. Produce uniform, cross-sectional shapes and depths relative to joint widths allowing optimum sealant movement capability.

D. Prime joint surfaces as recommended by sealant manufacturer for conditions:
   1. Limit application to surfaces to receive sealants.
   2. Mask off adjacent surfaces.

E. Sub-caulk joints without suitable backstop, to proper depth.

F. Tool sealants using sufficient pressure to fill voids.

G. Remove excess sealant adjacent to joints.

H. Hollow Metal Frames:
   1. Seal frames to wall.
   2. Seal frames to floor substrates and hard floor finishes.
   3. Do not seal frames to previously installed carpet and similar finishes.
   4. Seal hairline gaps where stops and rabbets of frame members intersect.

I. Acoustical Sealant:
   1. General:
      a. Apply acoustical sealant at joints, voids, and penetrations through wallboard to maximize sound control.
         1) Seal wallboard edges to adjacent construction at perimeters, behind control joints, and at openings and penetrations with a continuous bead of acoustical sealant.
         2) Install acoustical sealant at both faces of partitions at perimeters and through penetrations.
         3) Comply with ASTM C919 and with manufacturer's written recommendations for locating edge trim and closing off sound-flanking paths around or through assemblies, including sealing partitions above acoustical ceilings.
      b. Refer to Section 07 84 00 for firestopping of through-wall penetrations.
         1) Provide firestop sealant where required in fire-rated assemblies.

1. Base of walls:
   a. Apply acoustical sealant to bottom edge of gypsum wallboard at floor.
2. Head of walls:
   a. Apply acoustical sealant to top edge of gypsum wallboard at building structure.

3.4 SEALANT USAGE GUIDELINES

Guide to Sealant Types - INTERIOR				
Location	**Materials**	**Sealant Type**	**Base Product**	**Remarks / Exceptions**
Interior (General)	Window Sills / Stools	100% silicone	Color-Sil Poly-Sil	--
	Cabinets and Casework to wall			
	Countertops and Backsplashes			
	Sinks in Countertops			
	Interior Alum Doors and Window Frame Perimeters	Multi-part, chemically curing Polyurethane	Tremco Dymeric 240FC	--
	Non-rated wall, floor and deck penetrations.			
	Hollow Metal Door and Window Frames	Siliconized Acrylic Latex (paintable)	Tremco Tremflex 834	Exception: Where sealant will not be subsequently painted and white color will not be visually compatible with adjacent finishes: Use Dymeric 240FC of matching color.
	Acoustical Sealant Joints at top and bottom terminations of Interior Walls	Acrylic	Hilti CFS-SP WB	--
		Silicone	Hilti CP 601S	
Interior Flatwork	Control Joints in Concrete Floors in Mechanical Rooms and other un-finished spaces	Multi-part Polyurethane	Tremco THC 900 / 901	Exception: Where subject to continual water emersion; use Vulkem 45 or 245
	Stone and Precast Flooring			
Interior Wet Areas	Porcelain, Ceramic Tile, Metals, and surfaces with Epoxy Paints	Silicone; Air cure	Tremco Tremsil 200	--

1. The above is intended to be an overall guide. Additional conditions and materials may be required. Notify Architect if additional Guidance is required to select unlisted items.
2. Optional sealant products shall offer same number of color choices as the Base Product listed.
3. All of the conditions and materials listed may not necessarily apply to subject project.
4. Not all project conditions may be addressed on above table; Refer also to other specification sections and install sealants where called for by other sections.
5. Materials and Conditions conventionally occurring on Exterior but used on Interior (e.g. Brick Masonry on interior) may not be listed on this Table. Refer to Exterior Guide (Section 07 92 13) for appropriate sealant type.

END OF SECTION

DIVISION 08

OPENINGS

SECTION 08 06 00
DOOR, FRAME AND HARDWARE SCHEDULE

PART 1 - LEGEND

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Door, Frame and Hardware Schedule, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 ABBREVIATIONS

A. ALUM: Aluminum.

B. ANOD: Anodized.

C. HM: Hollow metal.

D. SS: Stainless Steel.

E. FRB: Fire-rated Borrowlite.

F. HW: Hardware.

G. LBL: Label.

H. MATL: Material.

I. MHO: Magnetic Hold Open.

J. HLDR: Mechanical Door Holder.

K. PL, PLAM: Plastic Laminate.

L. PNT: Paint.

M. PR: Pair.

N. DE: Double Egress.

O. WD: Wood.

P. STN: Stain.

Q. GL: Glass.

1.3 DESIGN REQUIREMENTS

A. Scheduled Dimensions:
   1. Dimensions given for swing doors refer to nominal door panel width and height; doors may be undercut a maximum dimension allowed by fire label.
   2. Dimensions given for package doors (i.e. automatic and manual sliders) refer to the overall package width and height, including frames, transoms, and multiple door panels. (See Door Type Elevations for additional clarity).
   3. Dimensions indicated as feet-inches; 3-0 = 3 feet - 0 inches.
   4. Doors are 1-3/4 IN thick unless otherwise noted.

B. Door and frame assemblies are minimum minute label noted.

C. WD doors are factory finished (stain); see Section 08 14 16.

1.4 DOORS

A. As indicated in Drawings.

1.5 FRAMES

A. As indicated in Drawings.

SECTION 08 11 13
HOLLOW METAL (HM) DOORS AND FRAMES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Hollow Metal Doors and Frames in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Hollow Door and Frame Standards:
   1. ANSI A250.4 Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors
   2. ANSI A250.8 / SDI 100 Recommended Specifications for Standard Steel Doors and Frames
   3. ANSI A250.11 Recommended Erection Instructions for Steel Frames

B. Fire Rated Doors and Frames:
   1. Label and list for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
   2. Affix physical label or approved marking to fire door or fire door frame at an authorized facility as evidence of compliance with procedures of labeling agency.
   3. Where pairs of doors require fire rating (90 minute maximum), doors shall have passed appropriate test without the use of astragals.
   4. Positive Pressure:
      a. Comply with Positive Pressure Requirements UL 10C, Category A or NFPA 252.

C. Smoke and Draft Control Assemblies:
   1. Maximum Leakage: 3 CFM per SF of door face area when tested at pressure of 0.10 IN water per UL 1784.
   2. Applicability:
      a. Doors in Smoke Partitions, Smoke Barriers and Corridor walls.
   3. Provide S-Labels on smoke and draft control openings.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Use same reference numbers for openings as those in Section 08 06 00 – Door and Frame Schedule or Door and Frame Schedule in Drawings
   2. Indicate door elevations, gauges; frame configuration; anchor types and spacing; location of reinforcement and preparations for hardware, including items recessed within door edges; details of moldings, removable stops, glazing and louvers; details of conduit and preparations for power, signal, and control systems.

B. Product Data:
   1. Include construction details, material descriptions, core descriptions, fire resistance rating and finishes.
   2. Shop primer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Hollow Metal Doors and Frames:
   1. Base:
      a. Steelcraft Manufacturing.
   2. Optional:
      a. Curries.
      b. Ceco Door Products.
      c. Philipp Manufacturing Company.
      d. Republic Doors and Frames.

2.2 MATERIALS

A. Steel sheet and strip:
   1. Typical: ASTM A568.

B. Primer:
   1. Clean and phosphatize doors and frames.
   2. One coat of baked-on rust inhibiting primer paint in accordance with ANSI A250.10.
   3. Suitable and compatible as base for specified finish paints.

2.3 HOLLOW METAL DOORS

A. Comply with ANSI/SDI A250.8.

B. Determination of performance level for each door:
   1. Use level of HM door indicated for its location, size and other listed criteria.
      a. Not all items below may apply to subject project.

Schedule of HM Door Levels			
Location	**Additional Criteria**	**HMMA Level**	**Miscellaneous**
Interior Doors	Non-fire rated	Level 3 (Extra Heavy duty)	--
	Fire rated	Level 3 (Extra Heavy duty)	Labeled as indicated (w/out astragal wherever possible)

General Notes:

Refer to Door Schedule for indication of the Door Type (I.e. Width, Fire Rating, Flush vs. Stile & Rail, etc)
Refer to Plans for door location (Exterior vs. Interior).

C. Construction - Hollow Metal (HM) Doors:
   1. Door Thickness: 1-3/4 IN.
   2. HM Door Level, per ANSI A250.8:
      a. Level 3, Extra Heavy duty, physical performance Level A.
         1) Face Sheet Thickness: 0.053 IN (16 GA).
   3. Typical Model, per ANSI A250.8:
      a. Model 2, Seamless.
   4. End closures at top and bottom of door:
      a. Top: Flush closure top cap. Minimum Sheet thickness: 0.032 IN (20 GA).
      b. Bottom: Flush closure. Minimum Sheet thickness: 0.032 IN (20 GA).
   5. Cores:
      a. Steel stiffeners where structurally required.
      b. Interior doors:
         1) Non-rated doors: Kraft honeycomb laminated to face sheets.
         2) Rated doors: Fire resistant core as required by label.
      c. Specific materials used for above listed core types: Manufacturer's option.

d. Reinforce for Hardware.

6. Vertical Door Edges:
   a. Lock Stile Edges: Beveled 1/8 IN per 2 IN.
      1) Exception for inactive leaves: Fabricate inactive leaves with a square edge at the lock stile edge. Active leaves to be beveled per above.
   b. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.
   c. Exceptions for Double Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles.

D. Hardware Reinforcement (doors):
   1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as door face sheets.
   2. Minimum thickness: As prescribed in ANSI/SDI A250.6; Upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
      a. Butt Hinges: 0.167 IN (7 GA).
      b. Closers and Overhead Stops: 0.067 IN (14 GA).

E. Lites:
   1. Provide light kits which are labeled for intended opening.
   2. Fixed Stop:
      a. Locate at exterior face.
      b. Integral to door/frame.
   3. Removable Stop:
      a. Locate on interior face.
   4. Snap-in stops or stops secured with countersunk Phillips head machine screws.

F. Overlapping Astragals:
   1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00 Hardware.
   2. Weatherstripping: Specified in Section 08 71 00.

2.4 HOLLOW METAL (HM) FRAMES

A. General:
   1. Comply with ANSI/SDI A250.8 and with details indicated for type and profile in accordance with SDI 111.
   2. Fabricate frames with mitered or coped corners and 1/2 IN nominal backbend.
   3. Touch-up galvanized/galvannealed frames with zinc-rich primer.

B. Fabricate frames as Face Welded (modified ANSI definition):
   1. Face Joints: Continuously back weld face joints (weld on concealed side).
      a. Fill and finish exposed sides to be free of visible seams.
   2. Intersections of Rabbets, Stops and Soffit Joints: Fabricate to hairline joints. Stitch weld on concealed side.
   3. Split type frames and knock down type frames are not acceptable.
   4. Fasteners which are exposed to view are not acceptable.

C. Determination of steel gauge for each frame:
   1. Per following schedule, use indicated minimum steel gauge as indicated for its location, size and other listed criteria.
   2. Note: Some items below may not apply to subject project.

Schedule of HM Frames			
Location	**Criteria**	**Minimum Thickness**	**Miscellaneous**
Interior Frames [1]	Non-fire rated	0.053 IN (16 GA)	---
	Fire rated	0.053 IN (16 GA)	---
	Frames for doors with automatic openers	0.067 IN (14 GA)	---

General Notes:

Gauge of frame listed is minimum. Use heavier gauge as required due to size, physical configuration or if required to meet fire label requirements.

Refer to Door Schedule for indication of the Frame Type (I.e. Width, Single vs. Pair; Fire Rating, etc)

Refer to Plans for door location (Exterior vs. Interior).

D. Lites:
   1. Provide light kits labeled for intended opening.
   2. Fixed Stop:
      a. Locate at exterior face.
      b. Integral to door/frame.
   3. Removable Stop:
      a. Locate on interior face.
      b. Snap-in stops or stops secured with countersunk Phillips head machine screws.

E. Silencers:
   1. Specified in Section 08 71 00.
   2. Quantity:
      a. Three on strike jamb of single frames.
      b. Two per door for pair doors. Locate at head.
   3. Space per manufacturer's recommendations.
   4. Use plastic plugs to keep holes clear during construction.

F. Hardware Reinforcement (frames):
   1. Fabricate according to ANSI/SDI A250.6 with reinforcement plates from same material as frames.
   2. Minimum thickness: As prescribed in ANSI/SDI A250.6; upgrade as necessary for conditions such as door weight, size, frequency, etc. and as follows:
      a. Butt Hinges: 7 GA.
      b. Closers and Overhead Stops: 0.093 IN (12 GA) thick x 12 IN long strapping welded to vertical flange of frame.

G. Head Stiffeners for Double Egress Frames:
   1. Purpose: To compensate for loss of stiffness at midspan due to discontinuity of head stops.
   2. Configuration: 12 IN long strapping welded to each vertical flange of frame.
   3. Minimum Thickness: 0.093 IN (12 GA).
   4. Position stiffeners at mid span of frame opening.

H. Junction Boxes:
   1. Definition: Sheet metal enclosure welded to back side of frames to facilitate pulling of wires and making electrical connections.

2. Material: 0.032 IN (20 GA) sheet steel.
3. Size and shape: As required by hardware device.
4. Include knock-out to receive 1/2 IN conduit.
5. Locate Junction Boxes in frames scheduled to receive electrified Security or Door Hardware devices or both.
   a. Devices including, but not limited to: Electric Strikes, Maglocks, Door Position Switches, Current conducting hinges, etc.

I. Jamb Anchors:
1. General:
   a. Material: ASTM A879 Commercial Steel, 4 OZ/SF coating; mill phosphatized.
      1) Exception for frames built into exterior walls: Steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
   b. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.
   c. Provide minimum number as indicated on following Table:

Jamb Anchors Minimum Quantity Required (per Jamb)	
Nominal Frame Height	**Minimum Quantity per Jamb**
Up to 60 IN	2
Between 60 IN and 90 IN	3
Between 90 IN and 120 IN	4
Between 120 IN and 150 IN	5
Taller than 150 IN	Add 1 additional for each 30 IN increase in height thereafter

2. Jamb Anchors for Stud Framed walls:
   a. Z-shaped clips, welded to inside of frames; not less than 0.042 IN (18 GA) thick.
   b. Attach anchors to studs with screws.
3. Jamb Anchors for Masonry walls:
   a. Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, not less than 0.042 IN (18 GA), with corrugated or perforated straps not less than 2 IN wide by 10 IN long; or wire anchors not less than 0.184 IN (6 GA) thick.
   b. Embed long leg into masonry wall as it is laid.
4. Post Installed Expansion Type for In Place Concrete or Masonry:
   a. Minimum 3/8 IN countersunk, flat head expansion bolts with expansion shields or inserts.
   b. Include pipe spacer from frame to wall, with throat reinforcement plate, welded to frame at each anchor location.
   c. Minimum embedment length: 1-3/4 IN.

J. Floor Anchors:
1. Material: Same for Jamb Anchors but not less than 0.053 IN (12 GA) thick.
   a. For anchors built into exterior walls, steel sheet complying with ASTM A1008 or ASTM A1011, hot-dip galvanized according to ASTM A153, Class B.
2. Application:
   a. Monolithic Concrete Slabs: Clip type anchors, with two holes to receive fasteners.
   b. Topped Slabs: Adjustable anchors with extension clips allowing not less than 2 IN height adjustment. Terminate bottom of frames at finish floor surface.
3. Include concealed fasteners.
4. Provide anchors in accordance with manufacturer's recommendations on fire rated doors.

K. Additional Head Anchors for Double Egress Frames:
1. Provide two head frame anchors for Double Egress frames.
2. Locate at third points of span.

L. Spreaders:
   1. Provide removable spreaders at bottom of door frames.

M. Inserts, bolts and fasteners:
   1. Manufacturer's standard units.
   2. Galvanize items built into exterior walls ASTM A153, Class C or D as applicable.

N. Grout:
   1. Portland cement based grout mixture: Specified in Section 04 05 13.
   2. Grout mixtures shall not contain gypsum.

2.5 MATERIALS – MISCELLANEOUS

2.6 FABRICATION

A. Factory fit doors to suit frame openings, with most stringent criteria for uniform clearances in accordance with:
   a. NFPA 80 for fire rated doors.
   b. NFPA 105 for smoke control doors.
   c. ANSI A250.8.
   d. Locally adopted Building Code.
   e. SDI 117.

Door To Frame Clearances Table

Location		Clearance
Door to Frame @ top and sides		1/8 IN
Meeting Stiles at Pair Doors		1/8 IN
Face of door to face of Stop		3/32 IN
Door Bottom to Floor / Flooring	Top of floor covering	Up to 1/2 IN
	Non-combustible sills	3/8 IN
	Bare floors; No flooring or sills	Up to 3/4 IN

B. Hardware Preparation:
   1. Factory prepare hollow metal work to receive templated mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to Door Hardware Schedule and templates furnished as specified in Section 08 71 00.
   2. Locate hardware indicated, or if not indicated, according to ANSI/SDI A250.8.
   3. Reinforce doors and frames to receive non-templated, mortised and surface mounted door hardware.
   4. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
   5. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26, 27 and 28 Sections.
   6. Remove mill scale and foreign materials, touch-up damaged galvanized or galvannealed surfaces.

C. Hollow Metal Doors:
   1. Glazed Lites: Factory cut openings in doors.
      a. Locate bottom of glazed panel 43 IN maximum above finish floor.
      b. Do not exceed area allowed by code for rated assemblies.
   2. Astragals: Provide overlapping astragal on one leaf of pairs of doors where required by NFPA 80 for fire performance rating or where indicated.

D. Prime:
   1. Shop prime.

E. Fire Labels:
   1. Affix permanent labels to fire rated units in accordance with testing agency requirements.
   2. Where labels are stamped or embossed directly into frame, ensure label will remain legible upon application of finishes.

F. Prepare frames for Door Position Switches (DPS):
   1. Coordinate locations with Security System provider.
   2. Locate DPS frame head approximately 4 IN from latching door edge.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine structure, substrates, and conditions under which work is to be installed for conditions detrimental to correct and timely completion.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION QUALITY CONTROL

A. Initially set frames plumb, level and square within allowable tolerances.

B. Verify plumb, level and square after walls are set and make adjustments where required.

C. Verify plumb, level and square again just prior to hanging doors, making adjustments as required. Verify door-to-frame clearances are within specified tolerances.

3.3 INSTALLATION

A. Frames:
   1. Place frames before construction of adjacent walls.
   2. Adjust hollow metal door frames for squareness, alignment, twist, and plumb to the following tolerances:
      a. Plumb: Plus or minus 1/16 IN, measured at jambs at floor.
      b. Level: Plus or minus 1/16 IN per leaf, measured across width of header.
      c. Square: Plus or minus 1/16 IN, measured at door rabbet on a line 90 degrees from jamb perpendicular to frame head.
      d. Alignment: Plus or minus 1/16 IN, measured at jambs on horizontal line parallel to plane of wall.
      e. Twist: Plus or minus 1/16 IN, measured at opposite face corners of jambs on parallel lines, and perpendicular to plane of wall.
   3. Do not remove spreaders until surrounding wall construction is complete.
   4. After surrounding walls have been constructed, verify that frames are still in proper alignment.
      a. Re-check for level, plumb, square, twist and other problems that will prevent proper fitting of doors.
      b. Correct deficiencies before surrounding construction is allowed to proceed.
      c. Coordinate with other trades to correct alignment problems.
   5. After wall construction is completed, remove temporary braces and spreaders, leaving surfaces smooth and undamaged.
   6. Verify frame alignment, and correct deficiencies prior to hanging doors.
   7. Install frames with removable glazing stops located on secure side of opening.

B. Frame-to-Wall Anchors:
   1. Utilize anchor type specified for wall condition.
   2. Align anchors at hinge centers on hinge jamb and at corresponding heights on strike jamb.
   3. Secure frame to wall per manufacturer's instructions.

C. Grout frames set into CMU and other masonry walls.

1. Do not grout frames set into metal stud framed wall types.
2. Field apply bituminous coating to backs of frames that are filled with grout
3. Install door silencers in frames before grouting.

D. Prime Coat Touchup:
1. Immediately after erection, sand smooth rusted or damaged areas of primer coat.
2. Touch up primer coat with compatible air drying primer.
3. Leave surfaces smooth for finish painting.

E. Field Painting of HM Frames and Doors:
1. Painting of Interior openings: Specified in Section 09 91 23.

F. Install Sealants:
1. Sealant:
a. Interior Sealants: Specified in Section 07 92 16.
2. Seal frames to walls.
3. Seal frames to floor slabs and hard floor finishes.
4. Hairline gap at intersections of head and jamb frames intersections of rabbets and stops:
a. Fill exposed seam with painter's caulk.

G. Install silencers.

3.4 ADJUSTING AND CLEANING

A. Alignment:
1. After surrounding walls have been constructed, verify frames remain in proper alignment.
2. Correct deficiencies before surrounding construction is allowed to proceed.

B. Protection Removal:
1. Immediately before final inspection, remove protective wrappings from doors and frames.

C. Leave work complete and in proper operating condition.

D. Verify that fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 14 16
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Flush Wood Doors, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturing Standards:
   1. Window and Door Manufacturer’s Association (WDMA) Industry Standard I.S. 1A

B. Source limitations:
   1. Obtain flush wood doors through one source from a single manufacturer.

C. Quality standard:
   1. WDMA I.S.1-A, Premium Grade.

D. ANSI A115. W Series, Wood Door Hardware Standards.

E. Fire Rated Door Standards:
   1. Label and list for ratings indicated by ITS – Warnock Hersey, UL or other testing and inspection agency acceptable to authorities having jurisdiction.
   2. A physical label or approved marking shall be affixed to the fire door or fire door frame, at an authorized facility as evidence of compliance with procedures of the labeling agency.
   3. Positive Pressure:
      a. Comply with Positive Pressure Requirements UL 10C, Category A or NFPA 252.
         1) The use of surface applied intumescents is not acceptable.
      b. Comply with ASTM E2074.

F. Smoke and Draft Control Assemblies:
   1. Maximum Leakage:
      a. 3 CFM per SF of door face area when tested at pressure of 0.10 IN water per UL 1784.
   2. Applicability:
      a. Doors in Smoke Partitions, Smoke Barriers and Corridor walls.
   3. Provide S-Labels on Smoke and Draft Control openings.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Indicate location, size, and hand of each door; elevation of each kind of door; location and extent of hardware blocking; and other pertinent data.
   2. Indicate dimensions and locations of cutouts.
   3. Indicate requirements for veneer matching.
   4. Indicate doors to be factory finished and finish requirements.
   5. Indicate fire ratings for fire doors.

B. Product Data:
   1. Include details of construction for each type of door.
   2. Include factory finishing specifications.
   3. Provide manufacturer's technical data for each type of door including details of core and edge construction, trim for openings and factory finishing specifications.

C. Samples:
   1. Samples for Verification: Factory finishes applied to actual door face materials for each material and finish.
      a. Provide one piece of specified finished work for each wood species and finish.
      b. Minimum Size: 8 x 10 IN indicating finish.

D. Contract Closeout Information:
   1. Warranty.

1.4 WARRANTY

A. Provide written warranty for doors for full life of installation against defects including:
   1. De-lamination, warp, twist, bow, telegraphing, and other defects that may impair or affect performance of door for purpose intended, meeting allowable values prescribed by WDMA Standard.
   2. Remove and replace defective doors; include cost of removal of defective units, re-hanging and refinishing of replacement units.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flush Wood Doors:
   1. Base:
      a. Marshfield Door Systems.
   2. Optional:
      a. Algoma Hardwoods.
      b. Eggers Industries.
      c. Graham Wood Doors.
      d. Mohawk Flush Doors, Inc.
      e. Oshkosh.
      f. VT Industries.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DOOR CONSTRUCTION

A. General:
   1. Except as otherwise indicated on drawings, fabricate work of this section to WDMA Premium Grade.
   2. Standard construction is per extra heavy duty performance levels.
   3. Factory finished.
   4. Performance Standards per WDMA I.S.1A-11:
      a. Extra Heavy Duty - Door must meet specified performance level without use of additional hardware blocking and without use of through bolts.
   5. Adhesives:
      a. Face adhesive per WDMA TM-6.
      b. Utilize waterproof adhesives for doors indicated near potentially wet conditions.
   6. Thickness: 1-3/4 IN unless noted otherwise.

2.3 CORE CONSTRUCTION

A. Select specific core types which comply with label for scheduled ratings, sizes and hardware devices.

B. Bond cores to stiles and rails; drop-in unbonded cores are not acceptable.

C. Non-Fire Rated Doors:
   1. PC-5, Extra Heavy Duty Wood Particleboard Core.

D. Fire Rated Doors - 20 minute:
   1. Core type indicated above for non-rated doors.

E. Fire Rated Doors - 45, 60 and 90 minute:
   1. Manufacturer's standard Fire Resistant Mineral Core construction as required by label and hardware schedule.
   2. Provide manufacturers standard edge to meet required fire rating.
   3. Include blocking as needed for surface applied hardware.

F. Stiles:
   1. Provide manufacturers standard edge to meet required fire rating.
   2. Fire rated doors: Fabricate stiles from fire retardant material as allowed by label.
   3. Meeting Stiles where concealed vertical rod (CVR) exit devices are scheduled.
      a. Avoid use of applied metal channels where label allows fire retardant material as an alterative.

G. Rails:
   1. Solid Hardwood or Structural Composite Lumber (SCL).

H. Cross-banding: Engineered wood or wood-based composite, securely bonded to core.
   1. Medium density fiberboard (MDF) not allowed.

I. Lites:
   1. Fire rated doors:
      a. Provide lite kits and fire rated glass tested as part of door assembly and labeled for intended opening.
      b. Locate bottom of glazed panel 43 IN maximum above finish floor.
      c. Locate fixed stop at exterior face integral to door.
      d. Locate removable stop on interior face.
      e. Snap-in stops or stops secured with countersunk Phillips head machine screws.
   2. Provide label as required for opening.

2.4 DOORS WITH TRANSPARENT FINISH – PREMIUM GRADE

A. General:
   1. Utilize WDMA Premium Grade criteria except as modified below.
   2. Veneer Thickness: 1/50 IN at 12 percent moisture content.
   3. Veneer Grade: HPVA Grade A.

B. Veneer Species (both faces unless otherwise noted):
   1. Red Oak.

C. Veneer Cut:
   1. Plain Sliced.

D. Veneer Leaf Match:
   1. Book match.

E. Face Assembly Match:
   1. Running.

F. Door-to-door Match: Match Pairs and sets.

G. Door Vertical Edges: Veneer edge banding, same species as face, no joints.

2.5 MISCELLANEOUS ITEMS

A. Overlapping Astragals:
   1. Provide approved overlapping astragals where required by label but not provided in Section 08 71 00, Hardware.

2.6 FABRICATION

A. Factory fit doors to suit frame openings, with most stringent criteria for uniform clearances in accordance with:
   1. NFPA 80 for fire rated doors.
   2. NFPA 105 for smoke control doors.
   3. ANSI A250.8.
   4. Locally adopted Building Code.
   5. WDMA - prefit clearances for factory fit doors.

Door To Frame Clearances Table		
Location		**Clearance**
Door to Frame @ top and sides		1/8 IN
Meeting Stiles at Pair Doors		1/8 IN
Face of door to face of Stop		1/8 IN
Door Bottom to Floor / Flooring	Typical; all floor covering types	Up to 1/2 IN
	At non-combustible sills	3/8 IN
	Bare floors; No flooring or sills	Up to 3/4 IN

B. Factory machine doors for hardware that is not surface applied.
   1. Comply with final Hardware Schedules, Frame Shop Drawings, and hardware templates.
   2. Coordinate measurements of hardware mortises in metal frames to verify dimensions and alignment before factory machining.
   3. Factory pre-drill pilot holes for surface applied items.

C. Hardware Preparation:
   1. Make cutouts accurately and neatly.
   2. Glazed Lites: Factory cut openings in doors.
      a. Locate bottom of glazed panel 43 IN maximum above finish floor.
      b. Do not exceed area allowed by code for rated assemblies.
   3. Provide two sets of glazing stop moldings for openings to completely cover cut edges.
      a. Neatly miter stops at corners.
   4. Cut and trim openings through doors to comply with applicable requirements of referenced standard for kinds of doors required.
   5. Finish as appropriate for material and type:
      a. Veneer wrapped Stops: Finish to match face veneer on doors.
      b. Solid Wood Stops: Finish to match face veneer on doors.
      c. Metal Stops: Paint in color to be selected by Architect.
   6. Fill nail holes in wood stops.

D. Top and Bottom Edges:
   1. Render top and bottom edges smooth, non-absorptive and readily cleanable.
   2. SCL rail finish: Make smooth with the application of veneer tape, plastic laminate or clear sealer to finish rough or porous edges.

E. Fire Labels:
   1. Affix permanent labels to fire rated units in accordance with agency requirements.
   2. On openings where continuous hinges, or other items which would conceal label, are scheduled: Locate labels on alternative locations as allowed by listing agency and local authorities.

F. Vertical Door Edges:
   1. Lock Stile Edges: Beveled 1/8 IN per 2 IN.

a. Exception for Inactive Leaves: Fabricate inactive leaves with a square edge at lock stile edge. Active leaves to be beveled per above.
2. Hinge Stiles Edge: Beveled 1/8 IN per 2 IN.
3. Exceptions for Double Acting Doors: Provide convex, radiused edges at lock stiles and hinge stiles. Kerf as required for Privacy Gaskets.

G. Finishes:
1. Comply with WDMA finish requirements.
2. Completely pre-finish doors at factory.
3. Transparent Finish Systems:
a. Stain (STN):
1) Type: Manufacturer's standard type.
2) Stain Color:
a) To be selected by Architect from Manufacturer's standard line.
3) System WDMA TR-6 Catalyzed Polyurethane.
4) Sheen: 30 to 40.

2.7 ACCESSORIES

A. Glazing Stops:
1. Select assemblies certified for fire ratings indicated and physically compatible with glazing type indicated.
2. Stop Material:
a. Fire Rated Doors:
1) Metal Vision Frames with Wood Veneer wrap; Veneer of same species as door facing.
b. Non-Fire Rated Doors:
1) Solid hardwood; Same species or compatible species with door facing.

B. Field Glazing of Non-rated Units:
1. Glass: Specified in Section 08 81 04.

C. Factory Glazing:
1. Glass in fire rated wood doors to be provided and factory installed by wood door manufacturer.
2. Schedule of Glazing Types:
a. Fire Rated Openings: Fire-rated, safety rated glazing of type required for rating indicated.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine doors and installed frames before hanging doors.
1. Verify suitability of openings to accept installation.
2. Verify that frames comply with indicated requirements for type, size, location and swing characteristics and have been installed with level heads and plumb jambs.
3. Do not hang doors in frames which are set out of plumb, out of square, or out of parallel until condition is rectified.
4. Work with frame installer and wall installer to correct misalignment issues.

B. Condition wood doors to ambient conditions, and within temperature and humidity levels recommended by manufacturer.

C. Reject doors with defects prior to hanging.

D. Proceed with installation only after unsatisfactory conditions have been corrected.

E. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install doors to comply with manufacturer's written instructions, referenced quality standard, and as indicated.

B. Pilot holes to be drilled for screws attaching hinges, closers, lock hardware and other devices to the stile or face of door.
   1. Pilot hole diameter shall not exceed 90 percent of the root diameter of the screw.

C. Fit doors to frames and machine for hardware, to extent not previously worked at factory.

D. Hardware: For installation, see Section 08 71 00, Door Hardware.

3.3 ADJUSTING

A. Adjust and check doors for proper fit function and uniform clearance at each edge to swing and operate freely.

B. Leave work complete and in proper operating condition.

C. Ensure fire labels are intact, and readily visible.

END OF SECTION

SECTION 08 31 13
SECUTIRY ACCESS PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Security Access Panels, as indicated, in accordance with provisions of Contract Documents.

B. Types of products in this section include the following:
   1. High security ceiling access panels.

C. Provide Security Access Panels in Security Ceiling as shown on the Drawings.

D. Completely coordinate with work of other trades.

1.2 RELATED WORK

A. Other related Specifications sections include Metal Security Ceiling.

1.3 QUALITY ASSURANCE

A. Uniformity: All access panels within this section shall be produced by a single manufacturer, including necessary accessories, fittings, and fastenings.

1.4 SUBMITTALS

A. Product Data: Submit five copies of manufacturer's technical data and installation instructions for Security Access Panels. Include complete schedule, including types, locations, sizes, wall and ceiling construction details, latching or locking provisions, and other data pertinent to installation.

B. Samples: Submit color samples on twelve inch by twelve inch squares of same metal to be used for fabrication of the access panels.

C. Shop Drawings: Submit one set of reproducibles and four sets of prints of all shop drawings for access panels, indicating field dimensions affecting installation. Show panels in detail including method of installation, edge reinforcement, frame, profiles, finishes and locking mechanism.

1.5 COORDINATION

A. Verification: Determine specific locations and sizes for access panels needed to gain access to concealed equipment by verification with trade requiring access.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Security Access Panels:
   1. Base:
      a. Karp Associates Inc.
      b. Larson's Manufacturing Inc.
      c. Milcor Inc.
      d. Nystrom, Inc.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Steel Sheet: ASTM A 366/A 366M commercial-quality, cold-rolled steel sheet with baked-on, rust-inhibitive primer.

B. Access Panels
   1. Provide high security access panels of not less than 10 gauge plate steel with heavy-duty butt hinges fully welded to panel and frame. Frame shall be 2” x 2” x 3/16” angles continuous welded construction.
   2. Install one Sothern-Folger #10 Series lock for each access panel. Lock to be provided by Security Door Hardware provider.
   3. Exposed Fasteners: All exposed fasteners shall have tamper-proof security type heads.

PART 3 - EXECUTION

3.1 PREPARATION

A. Advise installers of other work about specific requirements relating to access door or panel installation, including sizes of openings to receive access panels and frame, as well as locations of supports, inserts, and anchoring devices. Furnish inserts and anchoring devices for access panels that must be built into other construction. Coordinate with other work to avoid delay.

3.2 INSTALLATION

A. Comply with manufacturer’s instructions for installing access doors.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finished surfaces.

3.3 ADJUST AND CLEAN

A. Adjust hardware and panels after installation for proper operation.

B. Remove and replace panels or frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 31 16
ACCESS PANELS AND DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Access Panels and Doors, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

C. Provide where indicated:
   1. Architectural: See architectural drawings.
   2. Mechanical: Provided by Mechanical, See Section 20 05 00.
   3. Electrical: Provided by Electrical, See Section 26 00 10.

1.2 QUALITY ASSURANCE

A. Fire rated construction:
   1. Provide in fire rated walls, floors and ceilings.
   2. UL listed.

1.3 SUBMITTALS

A. Product data:
   1. Technical data on each type of access panel and/or door.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Access panels:
   1. Base:
      a. Milcor.
   2. Optional:
      a. JL Industries.
      b. Nystrom.
      c. Karp Associates.
      d. Williams Brothers.
      e. Acudor Products, Inc.
      f. Ventfabrics.

B. Panels for project by single manufacturer.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 ACCESS DOORS PANELS AND FRAMES

A. Size:
   1. As required to allow access, inspection, service, and removal of items served.
   2. Minimum 18 x 18 IN.
   3. Minimum 16 x 16 IN at CMU masonry walls.

B. Non-fire rated:
   1. Door panels: Minimum 0.053 IN (16 GA) steel.
   2. Frame: Minimum 0.053 IN (16 GA) steel.

C. Fire rated construction:
   1. Provide in fire rated walls, floors and ceilings.
   2. UL listed, 1-1/2 HR B fire rating.

D. Material:
   1. Carbon Steel, minimum 0.032 IN (20 GA).
   2. Finish: Factory primed.
   3. Paint in field:
      a. Specified in Section 09 91 23 for interior units.

E. Construction: Sandwich type door filled with insulation.

A. Latching Mechanism:
   1. Automatic door closing system.
   2. Cylinder operated steel cam lock with 2 keys; all units keyed alike.
      a. Exception: Standard screwdriver slotted cam locks may be used at units that are installed 90 IN or higher above floor or walking surface when measured to the centerline of latching mechanism.

B. Access doors, panels, and frames in ductwork: See Section 23 31 13 for additional requirements.

2.3 ACCESS DOOR TYPES

A. Style and type as required for wall or ceiling materials in which installed.

B. Flush Access Doors installed in gypsum wallboard walls and ceilings:
   1. Provide units with galvanized wallboard taping flange to be embedded in wallboard construction.
      a. Units to have a trimless final appearance when installation is complete.

C. Flush Access Doors installed in concrete, masonry and tile walls and ceilings:
   1. Provide units with exposed trim flange having a nominal face width of 1 IN or less.
   2. Paint trim to match door.
   3. Install with adjustable metal masonry anchors.

2.4 FABRICATION

A. Metal Surfaces:
   1. For metal surfaces exposed to view in the completed Work, provide materials with smooth, flat surfaces without blemishes.
   2. Do not use materials with exposed pitting, seam marks, roller marks, rolled trade names, or roughness.

B. Doors and Frames:
   1. Grind exposed welds smooth and flush with adjacent surfaces.
   2. Furnish attachment devices and fasteners of type required to secure access panels to types of supports indicated.

C. Latching Mechanisms:
   1. Furnish number required to hold doors in flush, smooth plane when closed.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Comply with manufacturer's written instructions for installing access doors and frames.

B. Set frames accurately in position and attach securely to supports with plane of face panels aligned with adjacent finish surfaces.

C. Install doors flush with adjacent finish surfaces or recessed to receive finish material.

3.2 ADJUSTING AND CLEANING

A. Adjust doors and hardware for proper operation.

B. Remove and replace doors and frames that are warped, bowed, or otherwise damaged.

END OF SECTION

SECTION 08 33 13
COILING COUNTER SHUTTER (CS)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Coiling Counter Shutters, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. National Fire Protection Association.(NFPA):
   1. NFPA 80 Standard for Fire Doors and Other Opening Protectives Handbook

1.3 SUBMITTALS

A. Shop Drawings:
   1. Indicate location and size of each door; elevation of each kind of door and other pertinent data
   2. Show anchorage details to adjacent wall construction.

B. Product Data:
   1. Manufacturer's standard literature for material submitted.

C. Project Information:
   1. UL Certificate for rated doors.

D. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.

1.4 WARRANTY

A. Manufacturer’s standard two (2) year warranty covering repair or replacement resulting from defects in material or workmanship.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Counter shutters:
   1. Base:
      a. Cornell.
   2. Optional:
      a. Cookson.
      b. McKeon.
      c. Overhead Door.
      d. Raynor.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 COMPONENTS

A. Curtain:
   1. 1-1/2 IN tall slats, interlocked to form an upward coiling curtain.

2. Nominal Thickness: 1/2 IN.
3. Gauge as determined by application, shutter width, and materials.
4. Type of material and finish as indicated for each shutter.
    a. Stainless Steel Slats:
        1) Flat face, Cornell type 1F.
        2) Thickness: 0.026 IN (22 GA) slats, or as required for UL Label.
        3) Finish:
            a) Brushed, No.4.
5. Endlocks:
    a. Minimum requirement: Provide high strength molded nylon endlocks at each end of alternating slats to act as a wearing surface and to maintain slat alignment.
    b. Motorized Shutters: Provide endlocks at each slat.

B. Bottom Bar:
1. Curtain to be reinforced with a tubular bottom bar.
2. Material and Finishes: As indicated for each unit.
3. Neoprene bottom seal to protect finish surface at sill.
    a. Except where Safety Edge is indicated.

C. Bracket plates:
1. Minimum thickness: 1/8 IN.
2. Fitted with sealed ball bearing on drive end.
3. Material and Finishes: As indicated for each unit.

D. Spring counterbalance:
1. Housed in a steel pipe of diameter and wall thickness to limit maximum deflection to 0.03 IN/FT.
2. Springs: Helical torsion type designed to include and overload factor of 25% and for optimal ease of operation.
3. Springs to be grease packed and mounted on a cold rolled steel inner shaft.
4. Spring Tension: adjustable from end of bracket plate.
5. Include safety stop lock bearing which senses a sudden rapid acceleration of the curtain and engages to prevent curtain from crashing to the floor in the event of a spring failure.
6. Sealed ball bearings to minimize wear of pipe shaft rotation around inner shaft.

E. Mounting:
1. Typical configuration:
    a. Face of wall (inside).
    b. Unless otherwise indicated.

F. Guide angles and wall angle assemblies:
1. Material and Finishes: As indicated for each unit.
2. Include UL approved guide gasketing to resist the passage of fire and smoke.

G. Sill:
1. Specified in Section 12 32 00.

H. Hood:
1. Typical profile:
    a. Round.
    b. Except where noted otherwise.
2. Reinforce to prevent sag.
3. Include intermediate hood supports where shutter width exceeds 16 FT.
4. Material and Finishes: As indicated for each unit.
5. Include Flame Baffle at Fire Rated openings.

2.3 MATERIALS & FINISHES – STAINLESS STEEL UNITS (SS)

Materials and Finishes for Stainless Steel (SS) Counter Shutters			
Component Item	**Material**	**Primer**	**Finish**
Curtain Slats	Stainless Steel	--	Brushed No.4
Bottom Bar	Stainless Steel	--	Brushed No.4
Wall/Guide Angles	Stainless Steel	--	Brushed No.4
Hood [1]	Stainless Steel [2]	--	Brushed No.4
End Bracket Plates	Stainless Steel [2]	--	Brushed No.4
Fascia [1]	Stainless Steel [2]	--	Brushed No.4

Footnotes:
1. Where required.
2. These items may be downgraded to Galvanized Steel where above ceiling and/or will not be exposed to view. Finish on Galvanized Steel, if used: Factory baked-on primer and Paint in field per Section 09 91 23.

2.4 OPERATION - MOTORIZED

A. General:
   1. Refer to Overhead Door Schedule for appropriate operation type for each opening.
   2. Comply with UL 325.

B. Motorized Shutters (M):
   1. High starting torque Motor rated for continuous duty:
      a. Minimum ___ HP, ___VAC, __ Phase.
   2. Gear reduction.
   3. Solenoid braking.
   4. Limit switches for upper and lower limits of shutter travel.
   5. Magnetic relay contactor.
   6. Overload protection.
   7. Pre-wiring to terminal block.
   8. Motor to be removable for repair without affecting hand operation.
   9. Safety System:
      a. Wireless Electric Safety Edge:
         1) Causes shutter to stop and reverse when an obstruction is encountered when closing.
         2) Self-monitoring, wireless.
   10. Back-up operation:
      a. Manual push-up (MPU):
         1) Provide lift handle on coil side.
         2) Force required: Not to exceed 25 LBS.
   11. Control Device Type:
      a. Key activated, flush mounted, 3 pushbutton control.
         1) OPEN button to fully open shutter when button is depressed (momentary contact).
         2) CLOSE button to close shutter when button is depressed (momentary contact).
         3) STOP button stops shutter in either direction (momentary contact).
      b. Interlock motor so that CLOSE button will be deactivated when shutter is in full down position and OPEN button will be de-energized when shutter is in full open position.
      c. Electronic interlock, which discontinues the motor operator when it senses that the curtain has been secured by mechanical locking device.
      d. NEMA Rating:
         1) NEMA 1 at interior, non-wet, mounting locations.
   12. Control Device Quantity:
      a. Install 1 per shutter opening where directed by Architect.
   13. Locking at motorized units:
      a. Primary:

1) Locking by motor operator's brake and gear drive.
b. Secondary:
1) Electric interlock with locking device to prevent operation of motor when manual lock device is engaged.
14. Fire rated Motorized Shutters:
a. Provide basic fire protection.
b. Slow, safe, controlled decent not exceeding 9 IN/Sec.
c. Activated by:
1) Local smoke/heat detection.
2) Fusible link.
d. Fail Safe operation.
e. Easily re-settable by Owner's Staff.
f. Base Product: M100 FireGard Motor Operated System by Cornell.

2.5 FIRE RATED COUNTER SHUTTERS (CD-FR)

A. Construction and features:
1. Comply with NFPA 80.
2. Shutters to be tested and approved by Underwriters Laboratory Inc.
a. Provide UL Label which meets or exceeds the value indicated on Overhead Door Schedule.
1) Where 20 or 60 minute (1/3, or 1-Hour) labels are indicated but are not available from shutter manufacturer, provide the next higher label which is available.
b. Provide UL approved, brush-type guide gasketing to resist the passage of smoke.
c. Hood to have flame baffle to prevent passage of smoke and flames.
1) Normally in open position.
2) Closes under fire condition, test condition, or power outage.
3) Motorized doors: Automatically returns to open position after power outage, test or fire condition.
d. Viscous speed governor to control the speed of descent.
3. Rated sill:
a. Integral sill by coiling shutter manufacturer.
4. Method of actuating release of curtain:
a. Fusible link melting at 165 degF.
b. Smoke Detection (Local):
1) Install smoke detectors on both sides of openings with auxiliary contacts connected to Fire Alarm Panel.
2) Type:
a) Ionization.
c. Diode and end of line resistor as approved by fire alarm manufacturer, at alarm control relay in auxiliary control panel, for operation from a supervised fire alarm signal circuit.
5. Base Product: M100 FireGard Closing Systems by Cornell.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate and opening to accept installation.

B. Installation signifies responsibility for performance.

3.2 INSTALLATION

A. By manufacturer or authorized representative.

B. Prior to occupancy, adjust shutter for smooth operation.

3.3 OPERATIONAL TESTING AND OWNER INSTRUCTION

A. Perform operational tests of units under normal conditions.

B. Perform tests in presence of Architect and Owner.

C. Instruct Owner's personnel regarding operational requirements.

END OF SECTION

SECTION 08 34 63

DETENTION HOLLOW METAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Detention Hollow Metal in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 REFERENCES

A. Publications listed in this article form a part of this specification to the extent referenced. In case of conflict, the most restrictive requirements shall apply.

B. American Society for Testing and Materials (ASTM), 1916 Race Street, Philadelphia, PA 19103:
   1. ASTM A370-07a: Test Methods and Definition for Mechanical Testing of Steel Products.
   2. ASTM A569-98: Specification for Steel, Carbon (0.15 Maximum Percent), Hot Rolled Sheet and Strip, Commercial Quality.
   3. ASTM 653/A653M-07: Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvaneeled) by the Hot-Dip Process.
   4. ASTM F 1233-98 (2004): Standard Test Method for Security Glazing Materials and Systems.
   5. ASTM F1450-05: Standard Test methods for Hollow Metal Swinging Door Assemblies for Detention Facilities.
   6. NAAMM 840-99: Installation and Storage of Hollow Metal Doors and Frames.
   7. NAAMM/HMMA 850-00: Fire Rated Hollow Metal Doors and Frames, Second Edition.
   8. ANSI/NAAMM 863-04: Guide Specifications for Detention Security Hollow Metal Doors and Frames.
   9. ANSI/NAAMM 863-04: Guide Specifications for Detention Security Hollow Metal Doors and Frames.

C. Underwriters Laboratories, Inc. (UL), 333 Pfingsten Road, Northbrook, IL 60062:

D. National Fire Protection Association (NFPA):
   1. UL10C-1998: fire Tests of Door Assemblies.
   2. UL752-05: Bullet Resisting Equipment.

E. National Fire Protection Association (NFPA):
   1. NFPA 80-2007: Standard for Fire Doors and Other Protective Openings.
   2. NFPA 101-2006: Life Safety Code.
   3. NFPA 252-08: Standard Methods of Fire Tests of Door Assemblies.

F. Door and Hardware Institute (DHI):
   1. Recommended Procedure for Processing Hardware Schedules and Templates – 96.
   2. Installation Guide for Doors and Hardware – 84.

G. American Welding Society.
   1. AWS D1.1, and D1.3, CSA W47.1-92 and RWMA, Resistance Welding Manual.

1.3 SUBMITTALS

A. Submit in accordance with Division 1.

B. Product data:
   1. Manufacturer's specifications for fabrication and installation.

C. Shop drawings.
   1. Door and frame elevations and sections.
   2. Listing of openings with descriptions including locations, gauges, and anchors.
   3. Details of openings.
   4. Details of hardware reinforcements, joints and connections, and light cut-outs.

D. Quality control submittals.
   1. Notorized statement from the Manufacturer attesting to conformance with the requirements, standards and testing required by this section.
   2. Provide a reference list showing detention projects for which the manufacturer has supplied security hollow metal. Include dates of completion.
   3. Notorized statement that manufacturer is a member of NAAM and will conform to the MAAM standards for fabrication methods and product quality control.
   4. Demolition of structures indicated.

E. Test reports:
   1. Statement from a nationally recognized independent testing laboratory, certifying that door and frame assemblies meet the standards and performance requirements specified.

1.4 QUALITY ASSURANCE

A. Single responsibility: The work of this section is intended to be included with the work of Section 11 1900 Detention Equipment and shall be assigned to the single responsibility of a qualified Detention Equipment Subcontractor (DES).

B. Manufacturer
   1. Personnel and plant equipment capable of fabricating security hollow metal assemblies of the type specified.
   2. Meet the standards set by the Hollow Metal Manufacturers Association (HMMA), a division of NAAMM for fabrication methods and project quality control.
   3. Member of NAAMM, subject to quality performance requirements for members.
   4. Welders currently qualified under AWS B2.1 or certified under CSA W47.1-92 Classification 2.1 to perform the type of work required.

C. Job Site Quality Verification
   1. At the Owner's option, a door at the job site may be selected at random and sawn in half or otherwise taken apart for verification that construction is in accordance with specifications. If the door construction conforms to the specifications, the Owner will reimburse the Contractor for the cost of a new door. If the door construction does not conform to specifications, the Contractor shall remove every detention door from the project and provide3 new doors conforming to the specification.

D. Regulatory Requirements
   1. Fire-Rated Door Assemblies: Where fire-rated door assemblies are indicated or required, provide fir-rated door and frame assemblies that comply with NFPA 80 and have been tested, listed, and labeled in accordance with NFPA 252 by a recognized independent testing and inspection agency acceptable to authorities having jurisdiction.
   2. Where fire-rated door or frame assemblies are indicated or required but essential detention features such as security glazing or accessories do not meet the criteria for labeling, if acceptable to the Architect, provide equivalent construction and "Certificate of Equivalence" along with specific documentation in the shop drawing submittal of why each door or frame assembly does not meet labeling criteria.

E. Pre-installation Meetings
   1. Hold pre-installation meeting with manufacturer and installers to review installation procedures.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTUERS

A. Detention Hollow Metal:
   1. Base:
      a. Habersham Metal Products Co., Cornelia, GA
      b. Trussbilt, Inc., St. Paul, MN

c. Chief Industries, Grand Junction, NE
d. Sweeper Metal Fabrication Corp., Drumright, OK

B. Other manufacturers desiring approval comply with Section 00 26 00..

2.2 TESTING AND PERFORMANCE

A. ASTM F 1450
1. Certify to successful completion and conformance wo the security grades and test load requirements for the specified security grade.
a. Include the following tests:
1) Bullet penetration (7.1), where door assemblies are specified or shown to be bullet resistant.
2) Door assembly impact test (7.2).
3) Door static load test (7.3).
4) Door rack test (7.4).
5) Door assembly fire test (7.5), where door assemblies are specified or shown as fire rated.
6) Door assembly and hardware tool attack test (7.6). Testing of individual door and frame components is acceptable.
7) Door edge crush test (7.7).
2. Provide door assemblies constructed the same as the test door assemblies.
a. Where door assembly cannot be certified as complying with ASTM 1450 because of additional specified requirements, provide proof of satisfactory completion of ASTM testing along with a certification from the manufacturer attesting that the assemblies are the same as the tested assemblies except for the modification.

B. Fire Door Assemblies.
1. In addition to the ASTM certification, certify that fire rated door assemblies meet or exceed the requirements of ASTM E-152 and UL 10C. Provide listing by Unferwriters Laboratories or other recognized testing agency having a factory inspection service and acceptable to the Authority having jurisdiction.

C. NAAMM
1. Comply with welding standards as defined in AWS D1.1 and D1.3, CSA WA7.1 and RWMA, Resistance Welding Manual.
2. Welds shall have complete penetration and fusion.
3. Remove parent metal when testing welds to failure.

2.3 SECURITY GRADES

A. Conform to the security grade requirements of ASTM F 1450:
1. Security grade 1: Minimum 2.3 mm (12 gauge) thickness door face sheet and 3.1 mm (10 gauge) thickness frame.
2. Security grade 2: Minimum 2.3 mm (12 gauge) thickness door face sheet and 2.3 mm (12 gauge) thickness frame.
3. Security grade 3: Minimum 1.7 mm (14 gauge) door face sheet and 2.3 mm (12 gauge) thickness frame.
4. Security grade 4: Minimum 1.7 mm (14 gauge) door face sheet and 1.7 mm (14 gauge) frame.

B. Refer to schedule in Part 3 for required security grades.

2.4 BASIC MATERIALS

A. Steel fabrications:
1. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames” ANSI/MAAMM HMMA 863.

B. Galvanizing:
   1. Galvanize or apply zinc coating in the following areas:
      a. Exterior doors and frames.
      b. Interior doors and frames subject to corrosive conditions.
      c. Other doors, frames, and components specified as galvanized.
   2. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames, ANSI/NAAMM HMMA 863”.

C. Supports, anchors, and fasteners:
   1. Manufacturer’s standard, not less than 1.3 mm (16 gauge) thickness, galvanized.
   2. Exposed fasteners: Torx® security type.

D. Finish:
   1. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames”, ANSI/NAAMM HMMA 863.Coat inside and outside surfaces of the frame and outside surfaces of the door with a rust inhibitive primer that meets or exceeds ASTM B117 salt spray for 150 hours and ASTM D1735 water fog test for organic coatings for 200 hours. Fully cure to develop maximum hardness and abrasion resistance prior to shipment.
   2. Treat surface to assure maximum paint adhesion.
   3. Coat inside and outside surfaces of the frame and outside surfaces of the door with a rust inhibitive primer that meets or exceeds ASTM B117 salt spray for 150 hours and ASTM D1735 water fog test for organic coatings for 200 hours. Fully cure to develop maximum hardness and abrasion resistance prior to shipment.

2.5 HARDWARE PREPARATION

A. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames”, ANSI/NAAMM HMMA 863.

B. Minimum thickness and size for hardware reinforcements:
   1. Mortise hinges and pivots:
      a. Minimum 3/16” thick x 10” high.
      b. Frame reinforcement: full width of frame.
      c. Provide additional reinforcement and bracing for top hinge by welding a 1” x 1” x 3/16” back-up angle to the inside of the frame.
   2. Surface applied security hinges: 1/4:” plate.
   3. Locking device hangar attachments: per device manufacturer’s template or installation instructions.
   4. Lock fronts and door reinforcement for closers: Minimum 2.3 mm (12 gauge) thickness.
   5. Internal reinforcements for surface applied hardware: Minimum 2.3 m (12 gauge) thickness. Reinforcement for door pulls shall not be less than 1 ½” x 12”.
   6. Strike or keeper: Minimum 3/16”.
   7. Frame reinforcement for closers: Minimum 3/16” x full width of the opening..
   8. Flush bolt reinforcements: Mininum 3/16”.
   9. Frame mounted electric lock pockets: Minimum 3/16” steel back plate or manufacturer’s standard 3.1 mm (10 gauge) thickness, one-piece lock pocket meeting ASTM test requirements.

C. Preparation for electrified hardware:
   1. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames” ANSI/NAAMM HMMA 863.
   2. Provide lock pockets and covers for frame mounted electrified locks. Fabricate pockets to allow a minimum of four inches above and below lock for wiring connections.
   3. Do not cut away the lock edge reinforcing channel more than necessary to pass lock.
   4. If cylinder extensions are not specified for locks keyed on two sides, provide recessed access to second cylinder. Recess shall be minimum of 6” x 6”.

D. Prepare the face of the door for cylinders, operating trim, and turn pieces.

2.6 FRAMES

A. Material thickness:
   1. As required by specified security grade.

B. Design and Construction:
   1. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames”, ANSI/NAAMM HMMA 863.

C. Silencers: Provide rubber door mutes conforming to ANSI/BHMA A156.16, type L03001, 3 per single door frame, 2 per double door frame.

D. Back Coating:
   1. Back Coat frames which are to be filled with grout or installed in concrete or masonry walls.
   2. Material: Water resistant bituminous coating.
   3. Back coating may be factory or field applied.

2.7 DOORS

A. Face Sheet Thickness:
   1. As required by specified security grade.

B. Design and Construction:
   1. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames”, ANSI/NAAMM HMMA 863.
   2. Steel Stiffeners, Provide either of the following:
      a. Continuous, vertically formed steel sections, formed of minimum 1.0 mm (18 gauge) thick steel, spanning the full thickness of the interior space between door faces, spaced no more than 4” apart and securely fastened to both face sheets by welds spaced a maximum of 3” on centers vertically.

C. Openings:
   1. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames”, ANSI/NAAMM HMMA 863.
   2. Shutters:
      a. Provide sliding shutters over vision lights or observation devices where shown on the drawings or specified in the detention hardware section schedule of hardware sets.
      b. Fabricate shutters of 3/16” steel with angle tracks. Provide ¼” solid stainless steel wire pull, minimum 3-1/2” center to center.
   3. Food Pass Openings:
      a. Provide where shown on the drawings or specified in the detention hardware section schedule of hardware sets.
      b. Opening: flush using 2.3 mm (12 gauge) minimum thickness interior channels securely welded to the inside of both face sheets. Continuously arc weld and dress smooth the four corner seams.
      c. Fabricate shutter from two 3.1 mm (10 gauge) thick steel plates, spot welded together to produce an inset fit that, when closed, will prevent tampering with the lock and hinges.
      d. Treat the shutter for maximum paint adhesion and apply rust inhibitive primer.
      e. Ship shutter loose for field installation.
   4. Speaking Devices:
      a. Provide speaking devices at cell door frames and where shown on the drawings or specified in the detention hardware section schedule of hardware. Conform to “Guide Specifications for Detention Security Hollow Metal Doors and Frames”, ANSI/NAAMM HMMA 863.

2.8 PANELS

A. Fabricate panels of the same materials and construction as specified for the doors.

2.9 CLEARANCES AND TOLERANCES

A. Unless otherwise shown or required by Code, locate hardware in accordance with "NAAMM 830-87" Hardware Preparation and Locations for Hollow Metal Doors and Frames."
   1. Hardware preparation
   2. Conform to "Guide Specifications for Detention Security Hollow Metal Doors and Frames", ANSI/NAAMM HMMA 863.

2.10 HARDWARE LOCATIONS

A. Unless otherwise shown or required by Code, locate hardware in accordance with "NAAMM 830-87" Hardware Preparation and Locations for Hollow Metal Doors and Frames."

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the conditions under which security hollow metal doors and frames are to be installed. Notify the Architect in writing of conditions that may be detrimental to the satisfactory and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

B. Verify that frames to be grouted or installed in masonry or concrete walls have been back coated with bituminous water resistant material.

3.2 PREPARATION

A. Prior to installation, examine frames and correct for size, swing, squareness, alignment, twist, and plumbness.

B. Back coat frames with bituminous water resistant material prior to installation. Back coating may be performed by the frame manufacturer or field applied.

3.3 INSTALLATION/ERECTION

A. Install in accordance with final shop drawings and manufacturer's instructions, and as specified.

B. Frames:
   1. Comply with the "Installation and Storage of Hollow Metal Doors and Frames", NAAMM HMMA 840.
   2. Place frames prior to construction of enclosing walls and ceilings.
      a. Set frames accurately in position, plumbed, aligned, and braced securely until permanent anchors are set.
      b. Install a minimum of two wood frame spreaders as shown in the installation guides. Do not use temporary bottom shipping spreaders for installation.
   3. Fully slush (grout) frames. Hand trowel a grout of 4" maximum slump consistency in place.
   4. Install fire rated frames in accordance with NFPA 80 "Fire Doors and Windows.
   5. Install anchors at locations and in quantities specified or shown on drawings.

C. Doors:
   1. Fit doors accurately in their respective frames in accordance with the "Installation and Storage of Hollow Metal Doors and Frames", NAAMM HMMA 840.
   2. Install fire rated doors in accordance with NFPA 80 "Fire Doors and Windows".
   3. Maintain specified door clearances, except for special conditions otherwise noted.

3.4 FIELD QUALITY CONTROL

A. Check installation of frames for squareness, alignment, twist, and plumbness.
   1. Use a PLS Frame Set Tool (Available from PLS frame set 502-538-9690) to check installation of door frames.
   2. If installation is not within the tolerances specified under "Preparation", remove and reinstall the frame in accordance with the specified tolerances.

B. Check that edge clearances for swinging doors do not exceed that specified under “Manufacturing Tolerances” in Part 2 of this specification. Metal hinge shims may be used to maintain clearances.

C. Verify that glazing sealant is pick resistant type.

3.5 ADJUSTING AND CLEANING

A. Keep hollow metal surfaces clean and free of grout, tar, or bonding material or sealer. Clean grout or other bonding material off of frames and doors immediately following installation.

B. Leave work clean and in proper operating condition. Remove defective work and replace with new material. Defective work includes but is not limited to doors and frames which are warped, bowed,or damaged.

C. Finish smooth exposed field welds and touch up with rust inhibitive primer.

D. Touch up primed or painted surfaces which have been scratched or marred during installation. Use rust inhibitive primer.

3.6 SCHEDULE OF SECURITY GRADES

A. Security Grades:
   1. Refer to Part 2 for security grade requirements.
      a. Detention Cells and Holding Rooms –Grade 1
      b. Evidence processing and evidence storage –Grade 2.
      c. Closets, storage, and janitor closets –Grade 3.
      d. Other detention hollow metal doors –Grade 2.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 - GENERAL

1.1 QUALITY ASSURANCE

A. Hardware Supplier Qualifications:
   1. Recognized architectural door hardware supplier, with warehousing facilities, who has been furnishing hardware in the project's vicinity for a period of not less than 2 years.
   2. On-staff, experienced Architectural Hardware Consultant (AHC) who is available, during the course of the Work, for consultation about project's hardware requirements.

B. Installer Qualifications:
   1. Supervised or inspected by certified Architectural Hardware Consultant (AHC).

C. Electrified Hardware Supplier Qualifications:
   1. Experienced door hardware supplier who has completed projects with electrified door hardware similar in material, design and extent to that indicated for this project and acceptable to manufacturer of materials.
   2. Prepare data for electrified door hardware based on testing and engineering analysis of manufacturer's assemblies similar to those in this project.

D. Fire-Rated Door Assemblies:
   1. Provide door hardware rated for use in assemblies complying with NFPA 80.
   2. Include listed and labeled hardware from a qualified testing agency, for fire-protection ratings indicated,
   3. Comply with Positive Pressure Requirements UL 10C, Category A or NFPA 252.

E. Smoke and Draft Control Assemblies:
   1. Maximum Leakage: 3 CFM per SF of door face area when tested at pressure of 0.10 IN water per UL 1784.
   2. Applicability:
      a. Doors in Smoke Partitions, Smoke Barriers and Corridor walls.
      b. Doors forming part of an Elevator Lobby enclosure.
   3. Provide S-Labels where required.

F. Finish designations and standards: Builders Hardware Manufacturers Association (BHMA) Standard 1301.

G. Regulatory Requirements:
   1. Barrier free design requirements of the local jurisdiction and Americans with Disabilities Act (ADA).
   2. Listing requirements of the local jurisdiction and UL listing where applicable by type.

H. Pre-installation Conference:
   1. Prior to installation of hardware, Construction Contractor conduct an on-site meeting to instruct hardware installer personnel in the proper installation of hardware and related electronics.
      a. Manufacturer's Reps for Locksets, Closers, Exit Devices and other major hardware devices shall be present and direct instruction of installers.
      b. Require attendance of affected parties, not limited to: Construction Contractor, hardware installer, electrical installer, door and frame installers and security installer, where applicable, and installer working with low voltage wiring of electromechanical hardware.
      c. Discuss installation sequence of components, point-to-point wiring diagrams, and address questions raised by installers.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Complete Hardware Schedule by door.
      a. Complete list of products including model numbers and cut sheets.
      b. Use Heading Numbers logically derived from Architect's Hardware Set numbers.
      c. Hardware Sets shall follow the guidelines established in Door & Hardware Institute Handbook (DHI) Sequence and Format for the Hardware Schedule.
   2. Diagrammatic Elevations and Point-to-Point Wiring Diagrams of openings scheduled to receive electrified hardware and electronic access control devices.
      a. Provide detailed wiring diagrams showing connections for signaling, control and locking functions and notes pertinent to programming, operation, etc.
      b. When door hardware sets include automatic operators and locking or latching hardware on the same doors, provide detailed wiring diagrams to coordinate with access control system specified in Section 28 10 00.
      c. Submit with Hardware Schedule.

B. Project Information:
   1. Certification that items bear UL label where required.
   2. Meeting minutes from Pre-Installation Meeting.

C. Contract Closeout Information:
   1. Schedule of components installed as hardware sets for each opening.
   2. Operating and maintenance data.
      a. Parts catalog for each product furnished.
      b. Keying records.
   3. Owner instruction report.
   4. Letter stating extra material has been delivered.

1.3 JOB CONDITIONS

A. Where exact types of hardware specified are not adaptable to finished shape or size of members requiring hardware, provide suitable types having as nearly as practical as the same operation and quality as type specified, subject to Architect's approval.

1.4 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of door hardware that fail in materials or workmanship within specified warranty period.
   1. Failures include, but are not limited to, the following:
      a. Structural failures including excessive deflection, cracking or breakage.
      b. Faulty operation of operators and door hardware.
      c. Deterioration of metals, metal finishes, and others beyond normal weathering and use.
   2. Warranty Period: Three years from date of Substantial Completion, except as follows:
      a. Electrified exit devices: 12 months from the date of placing the product in operation.
      b. Manual Closers: 10 years from date of placing the product in operation.

1.5 MAINTENANCE

A. Extra Materials:
   1. Provide special tools as supplied by hardware manufacturer, for each different or special hardware component.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Locks, Latches, and Deadbolts:
   1. Base:
      a. Yale Locks and Hardware – 8800 FL Series.
   2. Optional:
      a. No substitutions.

B. Cylinders:
   1. Base:
      a. Best Mortise Cylinder.

C. Exit Devices:
   1. Base:
      a. Corbin Russwin Hardware – ED4000/ED 5000 Series.
   2. Optional:
      a. Sargent Manufacturing – 80 Series.
      b. Yale Locks and Hardware – 7000 Series.

D. Door Closers:
   1. Base:
      a. Sargent Manufacturing – 351 Series.
   2. Optional:
      a. LCN Closers.
      b. Norton Door Controls – 7500 Series
      c. Stanley.
      d. Yale Locks and Hardware – 4400 Series.

E. Hinges:
   1. Base:
      a. Bommer.
   2. Optional:
      a. Stanley Hardware.
      b. McKinney Products.
      c. Ives.
      d. Hager Hinge
   3. Electric Transfer Hinges:
      a. McKinney Products – QC (#Wires)

F. Electromagnetic Locks (a.k.a. MagLocks):
   1. Base:
      a. Schlage.
   2. Optional:
      a. Securitron.

G. Electric Strikes:
   1. Base:
      a. Von Duprin.
   2. Optional:
      a. HES (Assa-Abloy).
      b. Securitron (Assa-Abloy).

H. Power Transfer Devices:
   1. Base:
      a. Von Duprin

2. Optional:
    a. Securitron.
    b. Security Door Controls.
    c. ABH Manufacturing.

I. Access Control Devices:
1. Base:
    a. Schlage Electronic Security.
2. Optional:
    a. Assa-Abloy (Sargent, Securitron, HES, Folger Adam).

J. Door Stops:
1. Base:
    a. Trimco.
2. Optional:
    a. Sargent Manufacturing.
    b. Corbin Russwin Architectural Hardware.
    c. Hager Hinge.
    d. Ives.

K. Overhead Stops and Door Holders:
1. Base:
    a. Rockwood.
2. Optional:
    a. Sargent Manufacturing.
    b. Rixson.
    c. Glynn-Johnson.
    d. Dorma.
    e. ABH Manufacturing.

L. Door Pulls, Pushplates, and Pushbars:
1. Base:
    a. Rockwood Manufacturing.
2. Optional:
    a. Hager Hinge.
    b. Burns Manufacturing.
    c. Ives.
    d. Trimco.

M. Kickplates, Armorplates, and Door Edging:
1. Base:
    a. Trimco.
2. Optional:
    a. Hager Hinge.
    b. Burns Manufacturing.
    c. Ives.
    d. Rockwood Manufacturing.
    e. ABH Manufacturing.

N. Flushbolts and Coordinators:
1. Base:
    a. Ives.
2. Optional:
    a. Door Controls.
    b. Rockwood.
    c. Hager Hinge.
    d. ABH Manufacturing.

O. Smoke Gaskets:
   1. Base:
      a. National Guard Products.
   2. Optional:
      a. Reese Enterprises.
      b. Pemko Manufacturing.
      c. Zero International.

P. Door Position Switches (DPS) by Security System:
   1. Provided by Security System Installer.

Q. Other materials:
   1. Base: As indicated.

R. Other manufacturers desiring approval comply with Section 00 26 00 and submit samples of both specified item and proposed item for comparison.

2.2 MATERIALS

A. General:
   1. Provide hardware for fire rated openings in compliance with UL, NFPA 80 and ADA guidelines.
      a. This requirement takes precedence over other requirements for such hardware.
      b. Provide only hardware which has been tested and listed by UL for types and sizes of doors.
   2. Furnish items of hardware for proper door swing.
   3. Tactile Warning:
      a. Etched, milled or knurled surface treatment.
      b. Provide on corridor-side levers of doors to loading platforms, boiler and mechanical rooms, stages, utility stairs, roof access, communications and electrical closets.
   4. On doors indicated with (LL) hardware, provide either lead lining or lead wrapping of case and thru-bolts as applicable to type of hardware to assure shielding integrity.
   5. Notify Architect of items which will not operate properly, attain the required fire label, and where components are physically or functionally incompatible.

B. Templates:
   1. Provide templates to door and frame suppliers.
   2. List template numbers on Hardware Schedule submittal for use by fabricators.
   3. Provide copies of approved Hardware Schedule to related suppliers, fabricators, and installers.
   4. Advise Architect of items which will not operate properly, attain the required fire label, and where components are physically or functionally incompatible.

C. Finishes:

Hardware Component	Satin Chrome Series			
	Base Metal	ANSI / BHMA	Finish Description	US Equiv
Locksets and Latchsets	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Door Pulls, Pushbars, and Pushplates	Stainless Steel	630	Satin Stainless Steel	US32D
Kickplates and Armorplates	Stainless Steel	630	Satin Stainless Steel	US32D
Exit Devices	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Hinges	Steel	652	Satin Chromium plated over nickel	US26D
Door stops, holders, dead locks, mortise bolts, pivots, door Edging and miscellaneous hardware	Brass/Bronze	626	Satin Chromium plated over nickel	US26D
Exposed arms and covers of closers:	Any	689	Powder Coated Aluminum Color	US20A

D. Fasteners:
   1. Manufacture hardware to conform to templates.
   2. Prepare for Phillips oval head machine screw installation unless directed otherwise.
   3. Exposed screws to match hardware finish or, if exposed in surfaces of other work, to match finish of other work as closely as possible.
   4. Fasteners in mineral core doors:
      a. Attachment of hinges:
         1) Use screws, which are fully threaded (from tip to head).
      b. Attachment of Closers:
         1) Use through-bolts at mineral core doors.
   5. Provide concealed fasteners (unless thru bolted).
   6. Provide non-corrosive fasteners.

2.3 CYLINDERS & KEYWAYS

A. Cylinders:
   1. Comply with BHMA A156.5 Grade 1.
   2. Material: Brass or bronze, stainless steel, or nickel silver.
   3. Finish: Match lock mechanism to which cylinders are installed.
   4. Cylinder Type: Interchangeable cores at Exit Devices; Conventional cores (non-interchangeable) at other locksets.
   5. IC Format: Full-sized Interchangeable Cores (IC).
   6. Cylinder Mechanism:
      a. Conventional, 6-pin tumbler.
   7. Key Control:
      a. Open.
   8. Determine key type required to suit locking mechanism. Include appropriate trim rings, cams, tail pieces, and adaptors.
   9. Patented cylinders and keys to protect against unauthorized manufacture.
   10. Provide cylinders for all locking mechanisms scheduled.
   11. Base Product:
      a. Best.
      b. Optional Products: None.

B. Keys:
   1. Material: Nickel-silver.
   2. Stamping: Permanently inscribe each key with a control number and the following: DO NOT DUPLICATE.
   3. Quantity: In addition to one extra blank key for each lock, provide the following:
      a. Cylinder Change Keys: 3.
      b. Master Keys: 6.
      c. Grand Master Keys: 6.
      d. Great-Grand Master Keys: 6.

2.4 LOCKS & LATCHES

A. Mortise Locks and Latches:
   1. ANSI/BHMA-A156.13, Series 1000, Operational and Security Grade-1.
   2. Mortise with antifriction latch bolt with 3/4 IN throw and deadbolt with 1 IN throw.
   3. Sectional trim (A) unless otherwise specified.
   4. Backset: 2-3/4 IN.
   5. Base Product: 8800 FL Series by Yale Locks and Hardware.
      a. Optional Products: None.
   6. Lever Style: AUR design.
   7. Rose Style: R6.
   8. Functions as indicated in Hardware Sets and in accordance with ANSI/BHMA-A156.13.

B. Electrified Locksets:
   1. Supplied by same manufacturer supplying conventional locks and latches

2. Design. level of quality, styles and finishes: Matching requirements listed above for locks and latches.
3. Operational Types (mortise):
   a. Electric Locking (EL); Power on locks one lever; Fail Safe if power is lost; Opposing lever always free.
      1) Base Product: L9080EL-RX by Schlage.
      2) Optional Products: 1070 RX by Sargent; 45HW DEL RQE by Best.
   b. RX micro-switches:
      1) Built-in switch to signal request-to-exit when occupant uses free lever to depart from the secured room or area.
      2) Security system to shunt alarm when signaled by RX switch.
      3) Include RX switch with Electrified Locksets unless otherwise indicated.

2.5 EXIT DEVICES

A. ANSI/BHMA-A156.3, Grade-1; Types and functions as scheduled by the HW-sets and as applicable for door material and other conditions indicated.

B. Fire Rated Openings:
   1. Use Fire-rated devices.

C. Non-rated openings:
   1. Typical: Use doggable (UL-listed for accident hazard) devices.
      a. Exception 1: Omit dogging where (non-fire rated) openings occur in a Smoke Partitions (Fire rated devices are also acceptable).
      b. Exception 2: Omit dogging where openings that include Card Readers and any where that dogging could compromise ability to secure the opening (Fire rated devices are also acceptable).

D. Where CVR (concealed vertical rod) and SVR (surface vertical rod) devices are scheduled:
   1. Include bottom rods at exterior openings.
   2. At interior openings: Provide LBR (Less Bottom Rod) where permitted by label. Include thermal (fire) pins and other required items to compensate.
   3. Where exposed bottom rods are required: Protect rods with rod and latch guards.
      a. Base product: RG-27 by Von Duprin.

E. Include cylinders at lockable devices.

F. Electrified devices:
   1. Include concealed Power Transfer devices where electrified Exit devices are scheduled.
      a. Select Power Transfer models having number of required number of conductors and conductors of the appropriate wire gauge recommended for the device served.
   2. Include Power Supply, type as required.

G. Lever Style: Match lever style specified for Locks and Latches.

H. Offset Pull Style: 1 IN diameter; 8190-0 by Ives/Von Duprin.

I. Base Products - Push Pad type (smooth-case): 98 Series by Von Duprin; Except 35 Series for narrow stile doors.
   1. Optional Products: 88-Series by Sargent; Apex 2000 Series by Precision.

J. Definition of Abbreviations:
   1. Device Types:
      a. **Rim**: Rim Device.
      b. **Mortise**: -75 Mortise Device.
      c. **SVR**: -27 Surface Vertical Rods.
      d. **CVR**: -47 Concealed Vertical Rod.
   2. Outside Trim Types:
      a. **EO**: Exit Only Trim; Function 01 - No cylinders, levers, pulls or other trim.
      b. **L**: Lever Trim; Function 08; Key locks/unlocks lever.
      c. **NL**: Nightlatch Trim Function 03 – Key in cylinder momentarily retracts bolt.

d. **OP**: 1 IN diameter offset wire pull Trim; Function 02 – Pull when dogged.
e. **OP-NL**: 1 IN diameter offset wire pull Trim; Nightlatch Function 03 – Key in cylinder momentarily retracts bolt.
f. **VRT**: Vandal-resistant Pull Trim.
g. **VRT-NL**: Vandal-resistant Pull Trim; Nightlatch Function 03 – Key in cylinder momentarily retracts bolt.
h. **EL**: Electric Locking Lever Trim; aka: Fail Safe.
i. **EU**: Electric Un-Locking Lever Trim; aka: Fail Secure.

3. Optional Functions:
   a. **ELR**: Electric Latch Retraction.
   b. **F**: Fire Rated Device.
   c. **E**: Electric locking.
   d. **CD**: Cylinder dogging.
   e. **LD**: Cylinder dogging.
   f. **LX**: Latch bolt monitoring.
   g. **RX**: Request to exit switch.
   h. **SS**: Signal switch.

2.6 STRIKES

A. Strikes:
1. Provide manufacturer's standard strike for each latching/locking mechanism.
   a. Finish: Match latch/lock device.
2. Standards: Comply with the following:
   a. Strikes for Bored Locks and Latches: BHMA A156.2.
   b. Strikes for Mortise Locks and Latches: BHMA A156.13.
   c. Strikes for Auxiliary Deadlocks: BHMA A156.5.
3. Strike Lip:
   a. Curved lip extended to protect frame.
   b. Locks with 3-piece antifriction latch bolts: Flat-Lip Strikes, where so recommended by manufacturer.
   c. Locks used on frames with applied wood casing trim: Extra-Long-Lip Strikes.

B. Strike Boxes:
1. Provide manufacturer's standard Wrought Strike Box for each latching/locking mechanism.
2. Provide specially fabricated Strike Boxes where set in aluminum framing.

2.7 DOOR CLOSERS (SURFACE-APPLIED)

A. Door Closers (surface-applied):
1. Comply with BHMA A156.4, Grade 1.
2. UL-listed for use on fire doors.
3. Body Material: Cast-iron.
4. Base Products:
   a. Models 4011 and 4111 by LCN.
   b. Models 4041 and 4041XP by LCN.
5. Optional Products:
   a. 281 Series by Sargent.
   b. QDC100 Series by Stanley.
6. Size door closers to comply with manufacturer's recommendations for door sizes, locations, and accessibility requirements for opening force.
7. Closers adjustable to 3 second closing speed from 70 DEG opening to 3 IN from latch.
8. Supply arms, brackets, and plates, as required.
9. Mount closers on room side of corridor doors, unless conditions prohibit such mounting.
   a. Where proposing to locate closers on Corridor side: Notify Architect, in writing, and obtain approval prior to installing.
10. Closers with integral back checks.
11. Entrance and vestibule doors: Delayed action closer and overhead stop.
12. Other exterior out-swinging doors: Closer with limiting cushion stop.

2.8 HINGES

A. Butt Hinges:
   1. Standards: Butts and Hinges: BHMA A156.1; Template Hinge Dimensions: BHMA A156.7; Self-Closing Hinges: BHMA A156.17.
   2. Full mortise, unless noted otherwise.
      a. Non-rising, flat button tips.
      b. Non-removable pins (NRP): Provide at out-swinging exterior doors and where specifically indicated.
   3. Following table refers to manufacturer's numbers that are considered equal:

Definition of Hinge Types						
Type	Manufacturer				Description	
	Hager	Stanley	Ives	McKinney	ANSI	Remarks
1	BB1199	FBB199	5BB1HW	T4B3386	A5111	Stainless Steel, Heavy Weight, 5-knuckle, 4 Ball Bearing, Non-ferrous for wet/exterior usage.
2	BB1168	FBB168	5BB1HW	T4B3786	A8111	Heavy Weight, 5-knuckle, 4 Ball Bearing, Steel w/ Steel Pin.

NOTES:

Use Type where indicated. It is possible that not all Types will be needed on subject project.

On openings with unequally sized pairs: Utilize same hinge model on both leaves; Hinge type listed for the larger/heavier leaf shall govern.

Use the appropriate variations of the above listed Model Numbers as necessary for actual door edge style specified (I.e. Bevel or Square Edge Doors).

McKinney TA series is also considered equal to its TB Series.

   4. Hinges Types according to door location and width:
      a. Type 1 - Stainless Steel, Heavy Weight, Ball Bearing Hinge:
         1) Exterior out-swinging doors with non-removable pins (NRP) option.
         2) Exterior in-swinging doors.
         3) Interior in-swinging doors to wet areas (showers, kitchens, etc.).
      b. Type-2 - Steel, Heavy Weight, Ball Bearing Hinge:
         1) Interior greater than 36 IN wide.
      c. Type-3 - Steel, Normal Weight, Ball Bearing Hinge:
         1) Interior less than or equal to 36 IN.
      d. Type-4 - Swing Clear, Steel, Heavy Weight, Ball Bearing:
         1) Use on openings where specifically indicated or scheduled.
         2) Upgrade to Stainless Steel for exterior and interior wet areas.
      e. Type 5 - Spring Hinges, Steel, Heavy Weight.
         1) Where specifically indicated or scheduled.
         2) Upgrade to Stainless Steel for exterior and interior wet areas.
         3) Use on steel gates in stairs.
      f. Type 6 - Double-acting spring Hinges, Steel, Heavy Weight.
         1) Where specifically indicated or scheduled.
         2) Upgrade to Stainless Steel for exterior and interior wet areas.

5. Hinge quantities per door leaf:

Hinge Quantities (based on Door Height)	
Nominal Leaf Height	**Minimum Number of Hinges Required each Leaf**
Up to 60 IN	2 hinges
Between 61 IN and 90 IN	3 hinges
Between 91 IN and 120 IN	4 hinges
Between 121 IN and 150 IN	5 hinges
Taller than 151 IN	Add 1 hinge for each 30 IN increase in leaf height thereafter

   a. Specialty Door configurations:
      1) Dutch doors: Refer to Table above for EACH individual leaf.
      2) Nurse-server doors: Refer to Table above for EACH individual leaf.
6. Hinge sizes:

Guide to Minimum Sizes of Hinges			
Door Thickness	**Door Width**	**Minimum Hinge Height**	**Minimum Hinge Width**
1-3/8 IN	Up to 32 IN	3-1/2 IN	3-1/2 IN
	From 32 IN to 36 IN	4 IN	
	Greater than 37 IN	4-1/2 IN	
1-3/4 IN	Up to 36 IN	4-1/2 IN	4-1/2 IN
	From 37 IN to 48 IN	5 IN	
	Over 48 IN	6 IN	
2 to 2-1/2 IN	Up to 42 IN	5 IN Heavy Weight	5 IN
	Over 43 IN	6 IN Heavy Weight	

NOTES:

1. *The above is a guide to minimum sizes. Consider the actual weight of door leaf being supported and its anticipated frequency of use when determining the actual hinge height.*
2. *Do not exceed parameters recommended by Hinge manufacturer.*
3. *Unequal Pairs: Utilize same hinge size for both leaves; Hinge height stipulated for the wider leaf shall govern.*
4. *Increase the hinge width as required to clear door trim where used. Ensure that door, when opened 180 Degrees will not contact the applied trim.*

2.9 ELECTROMAGNETIC LOCKS (MAGLOCKS)

A. General:
   1. BHMA A156.23 Grade 1.
   2. Provide UL-listed devices for continuous duty.
   3. Voltage: 24 VDC.
   4. Automatic Voltage Selection (AVS).
   5. Magnetic Bond Sensor (MBS) and LED indicator.
   6. Relock Time Delay (RTD).
   7. Integrated Door Position Switch (DPS).
   8. Include brackets and adapter plates as required for conditions.

B. MagLocks (standard type):
   1. Direct Hold electromagnet with minimum holding force: 1500 LBS per leaf.
   2. Anti-tamper switch (ATS).
   3. Base Product: M490P/M492P by Schlage.

C. MagLocks (Delayed Egress):
   1. Description: Self-continued unit designed to hold door securely until notified of request to exit.
   2. Direct Hold electromagnet with minimum holding force: 1500 LBS per leaf.
   3. Internal Plunger Switch to initiate delayed-egress cycle and auxiliary alarm.
      a. Include auxiliary alarm described below.
   4. Base Product: M490DEP/M492DEP by Schlage.

D. Alarm (for use with Delayed-Egress MagLocks):
   1. Adjustable Alarm tone.
   2. Adjustable Alarm volume up to 80 dB.
   3. Base Product: 1910 series by Schlage.

E. REX Motion Sensor (by Div 08); for use with standard MagLocks (where indicated):
   1. Usage: Used in conjunction with a standard MagLock where indicated as a Request-to-Exit device used to momentarily release maglock.
   2. Passive Infrared (PIR) motion sensor.
   3. Designed to momentarily release MagLock for exiting.
   4. Adjustable re-latch time up to 60 seconds.
   5. LED status indicator.
   6. Base Product: Scan II by Schlage.

2.10 POWER TRANSFER

A. Concealed: Mortised into edge of door and frame.
   1. UL listed.
   2. Determine number of conductors as required by application.

B. Finish: Match finishes indicated for hinges.

C. Base Products:
   1. EPT-2 and EPT-10 by Von Duprin.

D. Optional Products:
   1. CEPT-2/CEPT-10; PT200/PT1000 by ABH.
   2. PTM-2/PTM-10 by Security Door Controls.

2.11 CONTROLLED ACCESS ACCESSORY ITEMS

A. Keyswitch (KS):
   1. Maintained contacts unless otherwise noted; field-selectable to momentary action.
   2. Coordinate model variations as appropriate for application described.
   3. Red/green LED.
   4. Include Cylinder.
   5. Locate KS on walls where indicated.
   6. Base Product: I Disk to match existing system.

B. Exit Button (EB):
   1. Definition: Wall-mounted, lock release button for emergency egress.
   2. Momentary contacts.
   3. Base Product: 623-RD-EX by Schlage.

C. Remote Lock Release (RLR) Button - flush-mount in walls:
   1. Definition: Convenience releasing device, located remotely from opening, to release an electrified locking mechanism.
      a. Where used with Automatic Doors: RLR shall also activate operator to open.
   2. Momentary contacts.
   3. Base Product: 623-GR by Schlage.

D. Remote Lock Activation (RLA) Button - flush-mount, in-wall:
   1. Definition: Crisis lock activation device located remotely from opening, to activate and hold and electrified locking mechanism in the event of threat to facility or occupants.

a. Where used with Automatic Doors: RLA shall also disable other activation devices on the unsecured side.
2. Alternate-action/Maintained contacts.
3. Base Product: 623-GR-AA-DP by Schlage.

E. Remote Lock Release (RLR) Button - Surface-mounted under or under cabinets:
1. Definition: Convenience releasing device, located remotely from opening, for electrified locking mechanism.
a. Where used with Automatic Doors: RLR shall also activate operator to open.
2. Momentary contacts.
3. Base Product: 660-PB by Schlage.

F. Remote Lock Activation (RLA) Button - Surface-mounted at or under cabinets:
1. Definition: Crisis lock activation device located remotely from opening, to activate and hold and electrified locking mechanism in the event of threat to facility or occupants.
a. Where used with Automatic Doors: RLA shall also disable other activation devices on the unsecured side.
2. Maintained contacts.
3. Base Product: 660-T4 by Schlage.

G. Card Readers (OF/CI):
1. Furnished by Owner/Installed by Contractor.

H. Door Position Switches (DPS):
1. DPS are typically provided by Security System.
a. Exception: Where Hardware Sets specifically call for DPS to be provided by Section 08 71 00 (this section), refer to the following paragraph.
2. Div 08 Door Position Switches (DPS) specified herein:
a. Description: Magnetic, concealed mounting, normally closed contacts.
b. Provided and installed by Hardware supplier/installer.
c. Base Product: 1078/1076 by GE Interlogix/Sentrol.
1) Optional Products: 679-05WD/HM by Schlage; 3287 by Sargent; DPS-W/M by Securitron.

I. Request-to-Exit (REX) motion sensors by Security System:
1. REX devices provided with Security System where necessary to shunt alarm.
2. Provided/Installed by Security System Installer.

J. Request-to-Exit (REX) motion sensors by Division 08:
1. REX devices provided by Division 08 where used to momentarily drop a lock for free egress. (See Security System for REX Motion Sensors used to shunt alarm).
2. Passive Infrared (PIR) technology, un-affected by Fire Alarm Strobes, camera flashes, ambulance lights etc.
3. Adjustable latch time, up to 60 seconds.
4. Tilt adjustable.
5. Selectable Voltage: 12-24 VDC.
6. Base Product: Scan II by Schlage.
7. Optional Product: XMS by Securitron; DS150i by Bosch.

K. Miscellaneous Dry-Contact Relays:
1. SPDT, dry-contact relay (1 Form C) or similar variations as required for conditions.
2. Typical voltage rating and type: 24 VDC or other voltage combinations for the circuits being interconnected.

L. Fire Alarm Relays:
1. Specified with Fire Alarm System in Section 28 31 00.

M. Low Voltage Power (centrally supplied by Security System):
1. Unless otherwise noted, Owner’s Security System will provide low voltage power required to power items with current draw less than 2 AMP (24 VDC) including the following:
a. MagLocks.

b. Electric Strikes.
c. Electro-Mechanical Mortise Locksets.
d. Electro-Mechanical Cylindrical Locksets.

N. Power Supplies (PS) – Division 08 devices installed local to opening:
1. Provide filtered, regulated power.
2. Include relay modules that interface with Fire Alarm System.
3. Select power supply units that are:
a. Same brand as primary devices being powered.
b. Capable of receiving Fire Alarm Inputs.
c. Capable of interfacing scheduled hardware with automatic operators.
d. Include time delay modules where required for described function.
4. Electrified Exit Devices:
a. Base Product: PS914 by Von Duprin.
b. UL-listed.
c. Include options that interface with Fire Alarm and Automatic Operators.

2.12 OPERATING TRIM AND PROTECTIVES

A. Kickplates:
1. ANSI/BHMA-A156.6, Type J100.
2. Material: Stainless Steel; 0.050 IN thick.
3. Heights:
a. Kickplates: 8 IN high.
4. Widths:
a. Single Doors: 2 IN less door width (LDW).
b. Pair Doors: 1 IN less door width (LDW).
5. Bevel 3 edges of plates.
6. Coordinate installation of plates with locks and other hardware items; Cut-out where necessary.

B. Door pulls, Pushplates and Pushbars:
1. ANSI/BHMA-A156.6.
2. Door Pull (offset):
a. Tubular metal; 1 IN Diameter.
b. Size: 10 IN (CTC).
c. Base Product: Trimco 1191-3.
d. Optional Product: Ives 8190-0.
3. Pushplate:
a. Flat metal plate; 1/16 IN thick.
b. Size: 3-1/2 X 15 IN.
c. Base Product: Trimco 1001-2.
d. Optional Product: Ives 8200.
e. Provide cutouts as required for cylinders, deadbolts, etc.
4. Pushbar:
a. Tubular metal; 1 IN Diameter.
b. Size: Length as required by door width.
c. Base Product: Trimco 1741.
d. Optional Product: Ives 9100.
5. Pushbar & Offset Pull Set:
a. Tubular metal; 1 IN Diameter.
b. Pullbar Size: 10 IN (CTC).
c. Pushbar Size: Length as required by door width.
d. Base Product: Trimco 1737.
e. Optional Product: Ives 9190.
6. Heavy-Duty Pushbar:
a. Plate metal; 3/8 IN thick; 2-1/2 IN high.
b. Projection: 3-1/8 IN.

c. Length (center-to-center): Door width less 6 IN.
d. Base Product: Trimco 1633.

2.13 FLUSHBOLTS

A. General:
1. Include Flushbolts of type indicated in hardware sets.
2. The following models are considered equivalent:

Flushbolts						
MFR	Manual Flushbolts		Constant-Latching Flushbolts		Automatic Flushbolts	
	Wood Doors	Metal Doors	Wood Doors	Metal Doors	Wood Doors	Metal Doors
Ives	FB358	FB458	FB61P	FB51P	FB41P	FB31P
Door Controls	790F	780F	945	845	942	842
Rockwood	557	550	1945	2845	1942	2842

B. Automatic Flushbolts (AFB):
1. Rub/Strike Plate: Provide on active door leaf for each Automatic Flushbolt.
2. Include Dustproof Strikes.

C. Constant-latching Flushbolts (CLFB):
1. Rub/Strike Plate: Provide on active door leaf for each Automatic Flushbolt.
2. Include Dustproof Strikes.

D. Manual Flushbolts (MFB):
1. Include Dustproof Strikes.

E. Dustproof Strikes:
1. Base: Ives DP2.
2. Include with Flushbolts.

2.14 DOOR CONTROL DEVICES

A. Door Stops:
1. Provide Door Stop at each door leaf.
2. Use type as indicated in Hardware Set; however, where not specifically indicated in Hardware set provide following types:
   a. Wall-mounted Door Stops:
      1) Provide where door swings more than 110 degrees, and encounters a wall.
      2) Exceptions:
         a) Where door has pushbutton lockset, provide overhead type.
         b) Where double-acting door will not accommodate wall stop on each side of door, provide overhead type.
      3) Base Manufacturer: Ives.
         a) Wood Screw, plastic anchor: WS406CCV.
         b) Screw, drywall anchor: WS407CCV.
   b. Overhead Door Stops:
      1) Provide where door swings more than 110 degrees without encountering a wall:
         a) Doors up to 45 IN wide: Overhead stop Glynn-Johnson 450 Series.
         b) Doors over 45 IN wide: Overhead stop Glynn-Johnson 90 Series.
      2) Where exterior door does not have a closer, or does not swing against a wall: Overhead stop provide Glynn Johnson 90 series.
      3) Where exterior door has a closer and does not swing against a wall provide Glynn-Johnson 100 Series concealed overhead door stop.
      4) At Lead-lined doors provide Glynn-Johnson 90 series overhead door stop.

5) Where double-acting door has no wall adjacent: Glynn-Johnson 100 Series concealed overhead door stop.

B. Door Coordinators:
1. Base: Ives, COR Series.
2. Optional: Door Controls, 600 Series.
3. Provide where indicated.
4. Provide where Astragals are used.
a. Exceptions:
1) Coordinators are not required at double egress pairs.
2) Coordinators are not required where manual Flushbolts are used.
b. Provide where Automatic and Constant-latching Flushbolts are used.
5. If coordinator is provided for door which has stop which lacks enough surface area to allow proper mounting; provide shims, bars, etc., as required.
6. Provide solid shim or other fascia piece that will result in surface being flush with edge of coordinator.
7. Provide filler sections as required to finish opening.

2.15 SOUND, FIRE AND SMOKE SEALS

A. General:
1. Provide approved seals as necessary to achieve the fire/smoke labels indicated.
2. Fire and smoke seals are not specifically listed in Hardware Sets but are required to comply with applicable Building Codes and Fire Codes.
3. Refer to Doors Schedule and Floor Plans for indication of Fire Walls, Fire Barriers, Fire Partitions, Smoke Barriers, and Smoke Partitions.

B. Performance:
1. Fire Door Assemblies (other than openings also requiring smoke control):
a. Maximum Air Leakage: Not to exceed 0.50 CFM/FT of crack length as tested according to ASTM E 283.
2. Smoke- and Draft-Control Door Assemblies:
a. Where smoke- and draft-control door assemblies are required, provide seals that meet requirements of assemblies tested according to UL 1784 and installed in compliance with NFPA 105.
b. Air Leakage Rate: Maximum air leakage of 3 CFM/FT^2 at the tested pressure differential of 0.1 IN of water.

C. Perimeter Gaskets:
1. BHMA A156.22; UL-approved for conditions.
2. Base Product – Frame perimeter seals at jambs and heads:
a. 797 by Reese; S88 by Pemko.
3. Base Product - Meeting Stiles:
a. 93 by Reese; S305 by Pemko.

D. Astragal:
1. Provide where indicated.
a. Where not indicated:
1) Provide as necessary to obtain fire label.
2) Provide on pair doors located on exterior wall.
3) Provide on pair doors located on lead lined walls.
2. Fire-rated Openings:
a. Flat steel:
b. UL listed for labeled doors.
3. Exterior Openings:
a. Aluminum with weatherstripping gaskets.

2.16 SILENCERS

A. General:
   1. Silencers are not listed in Hardware sets but are required as described in this Article.
   2. Provide Silencers at openings except those receiving perimeter gasketing such as weather, fire, fire/smoke, and sound gaskets.

B. Silencers:
   1. Diameter: 1/2 IN.
   2. Projection: 1/8 IN.
   3. Tamper-proof.
   4. Base Product – Steel Frames: SR64 by Ives.

2.17 MISCELLANEOUS HARDWARE ITEMS

A. Closet Door Hardware:
   1. Four wheel ball bearing hanger set with detachable hanger plates.
   2. 150 pound door capacity.
   3. Include track, mounting hardware and other accessories required for complete installation.
   4. Base Product: Stanley BP150N.
   5. Optional Products: Hafele HAWA Junior 80/Z; Grant series 71.

B. Hardware, miscellaneous:
   1. Standard items by Emhart, Ives, or Sargent.

2.18 ELECTROMAGNETIC DOOR HOLDERS (SPECIFIED ELSEWHERE)

A. Magnetic Door Hold-open devices (MHO):
   1. Specified with Fire Alarm System in Section 28 31 00.
   2. MHO are indicated in HW-sets for coordination purposes.

2.19 EXTRA MATERIAL

A. Deliver to Owner extra materials from same production run as products installed.
   1. Package products with protective covering and identify with descriptive labels.

B. Interchangeable cores:
   1. Provide 10 extra for each Master-keyed group.

C. Extra Keys:
   1. As specified in Article entitled: Operation – Keying

2.20 OPERATION - KEYING

A. Establish keying system with Owner:

B. Provide and set up complete visible card indexed system with key tags and control slips.

C. Tag and identify keys and install in key cabinet.

D. Provide 3 keys for each lock mechanism.

E. Master key and key in groups as directed.
   1. Provide 6 master keys for each group.

F. Grand Master key and key in as directed.
   1. Provide 6 copies of grand master keys.

G. Great Grand Master key and key in as directed.
   1. Provide 6 copies of grand master keys.

H. Key to existing master key system.

I. Construction Keying:
   1. Provide cylinders with feature that permits voiding of construction keys without cylinder removal.
      a. Provide 10 construction master keys.
   2. Provide construction keying for exterior doors and primary entrances to construction areas.
      a. Construction Manager/General Contractor shall determine which openings will require construction keying based on sequence of construction activities.

2.21 DOOR HARDWARE SCHEDULE

A. The hardware sets represent the design intent and direction of the owner and architect. They are a guideline only and should not be considered a detailed hardware schedule. Discrepancies, conflicting hardware and missing items should be brought to the attention of the architect with corrections made prior to the bidding process. Omitted items not included in a hardware set should be scheduled with the appropriate additional hardware required for proper application and functionality.

B. Manufacturer's Abbreviations:
   1. MK – McKinney
   2. PE – Pemko
   3. YA – Yale
   4. SA – Sargent
   5. RO – Rockwood
   6. RF – Rixson
   7. NO – Norton
   8. SU – Securitron
   9. 00 – Other

Set: HW-1

6 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
2 Fire Exit Device SVR-LBR (lever)	12 63 NB8713 ETL	10BE/613E	SA
2 Fire Exit Device SVR-LBR (EO)	12 NB8710	10BE/613E	SA
2 Electromagnetic Holder	998 Verify Voltage with Fire Alarm System	10BE/613E	RF
1 Gasketing - Smoke Seal	S88BL LAR		PE
1 Astragal (Meeting Stile)	S771BL x Height		PE

Set: HW-2

3 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1 Fire exit device Rim (passage)	12 8815 ETL	10BE/613E	SA
1 Door Closer	CPS7500	10BE/613E	NO
1 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1 Gasketing - Smoke Seal	S88BL LAR		PE

Set: HW-3

4 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
2 Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
2 Electric Exit Device (elec lever FS)	53 55 63 NB8773-12v ETL	10BE/613E	SA
2 Door Closer	CPS7500	10BE/613E	NO
2 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1 Gasketing - Smoke Seal	S88BL LAR		PE
1 Gasketing	303AS		PE
2 Door Bottom Automatic	411ARL x Width		PE
1 Astragal (Meeting Stile)	S771BL x Height		PE
1 Frame Wire Harness	QC-C1500P		MK
1 Door Wire Harness	QC-C3**** (length / type as required)		MK
1 Power Supply	BPS-12/24-1		SU
1 I Disk - security	Mount adjacent outdoor frame		00

Set: HW-4

4 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
2 Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
2 Fire Rated Electric Exit Device SVR-LBR (RX/LX Elect Lever-FS)	12 53 55 63 NB8773-12/24v ETL	10BE/613E	SA
2 Door Closer	CPS7500	10BE/613E	NO
2 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1 Gasketing - Smoke Seal	S88BL LAR		PE
1 Gasketing	303AS		PE
2 Door Bottom Automatic	411ARL x Width		PE
1 Astragal (Meeting Stile)	S771BL x Height		PE
1 Frame Wire Harness	QC-C1500P		MK
1 Door Wire Harness	QC-C3**** (length / type as required)		MK
1 Power Supply	BPS-12/24-1		SU
1 I Disk - security	Mount adjacent outdoor frame		00

Set: HW-5

2 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1 Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
1 Electric Exit Device (elec lever FS)	53 55 63 8873-12v ETL	10BE/613E	SA
1 Door Closer	CPS7500	10BE/613E	NO
1 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1 Gasketing - Smoke Seal	S88BL LAR		PE
1 Gasketing	303AS		PE
1 Door Bottom Automatic	411ARL x Width		PE
1 Frame Wire Harness	QC-C1500P		MK
1 Door Wire Harness	QC-C3**** (length / type as required)		MK

1 Power Supply	BPS-12/24-1		SU
1 I Disk - security	Mount adjacent outdoor frame		00

Set: HW-6

3 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1 Mortise Lock	AUR6 8805FL	10BE/613E	YA
1 Door Closer	CPS7500	10BE/613E	NO
1 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
3 Silencer - Metal Frame	608		RO

Set: HW-7

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1 Mortise Lock	AUR6 8822FL	10BE/613E	YA
1 Wall Stop	406/409 to suit	10BE/613E	RO
3 Silencer - Metal Frame	608		RO

Set: HW-7A

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1 Mortise Lock	AUR6 8822FL	10BE/613E	YA
1 Concealed Overhead Stop	5-X36	10BE/613E	RF
3 Silencer - Metal Frame	608		RO

Set: HW-8

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1 Mortise Lock	AUR6 8802FL	10BE/613E	YA
1 Wall Stop	406/409 to suit	10BE/613E	RO
3 Silencer - Metal Frame	608		RO

Set: HW-9

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1 Mortise Lock	AUR6 8802FL	10BE/613E	YA
1 Concealed Overhead Stop	5-X36	10BE/613E	RF
3 Silencer - Metal Frame	608		RO

Set: HW-10

2 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1 Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
1 Electric Exit Device (elec lever FS)	53 55 63 8873-12v ETL	10BE/613E	SA
1 Door Closer	CPS7500	10BE/613E	NO
1 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1 Gasketing	303AS		PE
1 Door Bottom Automatic	411ARL x Width		PE
1 Astragal (Meeting Stile)	S771BL x Height		PE
1 Frame Wire Harness	QC-C1500P		MK
1 Door Wire Harness	QC-C3**** (length / type as		MK

	required)		
1 Power Supply	BPS-12/24-1		SU
1 I Disk - security	Mount adjacent outdoor frame		00

Set: HW-11

3 BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1 Exit Device Rim (EO)	8810	10BE/613E	SA
1 Door Closer	PR7500	10BE/613E	NO
1 Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1 Wall Stop	406/409 to suit	10BE/613E	RO
1 Gasketing	303AS		PE
1 Door Bottom Automatic	411ARL x Width		PE
3 Silencer - Metal Frame	608		RO

Set: HW-12

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1 Mortise Lock	AUR6 8807FL	10BE/613E	YA
1 Wall Stop	406/409 to suit	10BE/613E	RO
3 Silencer - Metal Frame	608		RO

Set: HW-13

3 BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1 Mortise Lock	AUR6 8807FL	10BE/613E	YA
1 Concealed Overhead Stop	5-X36	10BE/613E	RF
3 Silencer - Metal Frame	608		RO

Set: HW-14

3	BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1	Mortise Lock	AUR6 8801FL	10BE/613E	YA
1	Concealed Overhead Stop	5-X36	10BE/613E	RF
3	Silencer - Metal Frame	608		RO

Set: HW-15

3	BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1	Pull Plate - 4" x 16"	107x70C	10BE/613E	RO
1	Push Plate - 6" x 16"	70E	10BE/613E	RO
1	Door Closer	7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Mop Plate	K1050 4" 4BE CSK	10BE/613E	RO
1	Wall Stop	406/409 to suit	10BE/613E	RO
3	Silencer - Metal Frame	608		RO

Set: HW-16

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Exit Device Rim (lever)	63 8813 ETL	10BE/613E	SA
1	Door Closer	PR7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE
3	Silencer - Metal Frame	608		RO

Set: HW-17

1	Bi-Fold Door Hdwe	HF(2 or 4)/100A x Length Required		PE
2	4" Pull	856	10BE/613E	RO

Set: HW-18

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Mortise Lock	AUR6 8807FL	10BE/613E	YA
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE
3	Silencer - Metal Frame	608		RO

Set: HW-19

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Mortise Lock	AUR6 8807FL	10BE/613E	YA
1	Door Closer	7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE
3	Silencer - Metal Frame	608		RO

Set: HW-20

2	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
1	Electrified Mortise Lock	AUR6 8891FL 12/24v	10BE/613E	YA
1	Door Closer	7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE
3	Silencer - Metal Frame	608		RO
1	Frame Wire Harness	QC-C1500P		MK
1	Door Wire Harness	QC-C3**** (length / type as required)		MK
1	Power Supply	BPS-12/24-1		SU
1	I Disk - security	Mount adjacent outdoor frame		00

Set: HW-21

3	BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1	Mortise Lock	AUR6 8801FL	10BE/613E	YA
1	Wall Stop	406/409 to suit	10BE/613E	RO
3	Silencer - Metal Frame	608		RO

Set: HW-22

2	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
1	Electrified Mortise Lock	AUR6 8891FL 12/24v	10BE/613E	YA
1	Concealed Overhead Stop	5-X36	10BE/613E	RF
1	Gasketing - Smoke Seal	S88BL LAR		PE
1	Frame Wire Harness	QC-C1500P		MK
1	Door Wire Harness	QC-C3**** (length / type as required)		MK
1	Power Supply	BPS-12/24-1		SU
1	I Disk - security	Mount adjacent outdoor frame		00

Set: HW-23

3	BB Hinge	TA2714 4-1/2" x 4-1/2"	10BE/613E	MK
1	Mortise Lock	AUR6 8864FL	10BE/613E	YA
1	Door Closer	7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Mop Plate	K1050 4" 4BE CSK	10BE/613E	RO

1	Wall Stop	406/409 to suit	10BE/613E	RO
1	I Disk - security	Mount adjacent outdoor frame		00

Set: HW-24

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Exit Device Rim (lever)	63 8813 ETL	10BE/613E	SA
1	Door Closer	PR7500	10BE/613E	NO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing – smoke seal	S88BL LAR		PE
3	Silencer - Metal Frame	608		RO

Set: HW-25

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Mortise Latch	AUR6 8801FL	10BE/613E	YA
1	Door Closer	PR7500	10BE/613E	NO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE
3	Silencer - Metal Frame	608		RO

Set: HW-26

2	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Electric Hinge	TA2714 4-1/2" x 4-1/2" QC12	10BE/613E	MK
1	Electrified Mortise Lock	AUR6 8894-2FL 12/24v	10BE/613E	YA
1	Door Closer	7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Wall Stop	406/409 to suit	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE
3	Silencer - Metal Frame	608		RO
1	Frame Wire Harness	QC-C1500P		MK
1	Door Wire Harness	QC-C3**** (length / type as required)		MK
1	Power Supply	BPS-12/24-1		SU
1	I Disk - security	Mount adjacent outdoor frame		00

Set: HW-27

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E	MK
1	Push Bar		10BE/613E	
1	Door Closer	CPS7500	10BE/613E	NO
1	Kick Plate	K1050 8" 4BE CSK	10BE/613E	RO
1	Gasketing	303AS		PE
1	Door Bottom Automatic	411ARL x Width		PE

Set: HW-28

3	BB Hinge NRP	TA2714 4-1/2" x 4-1/2" NRP	10BE/613E MK
2	Exit Device Rim (lever)	63 8813 ETL	10BE/613E SA
2	Door Closer	7500	10BE/613E NO

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Coordinate reinforcement or other preparation of doors and frames.

C. Installation constitutes responsibility for performance.

D. Coordinate installation power supply and communication wiring to electrically operated devices.

3.2 INSTALLATION

A. Install in accordance with manufacturer's installation instructions, supervised or inspected by an AHC.

B. Fit hardware before final door finishing.

C. Permanently install hardware after finishing operations are complete.

D. Protect finishes by temporary coverings as required.

E. Mounting Heights:

Mounting Heights of Hardware	
Item	**Height** [1,2] (to Item Centerline)
Mortise Locksets	40-5/16 IN AFF to Centerline of Strike [3]
Cylindrical Locksets	
Patient Latches	
Exit Devices	
Door Pulls	42 IN AFF to Centerline of Pull
Pushplates	45 IN AFF to Centerline of Plate
Auxiliary Deadbolts	48 IN AFF to Centerline of Strike
Butt Hinges (and Pivots)	Top Hinge: Not more than 11-3/4 IN down from frame
	Bottom Hinge: Not more than 13 IN above floor
	Equally spaced between Top and Bottom Hinges. Refer to Part 2 for quantity required.
Other Items	Comply with SDI and DHI Recommendations

Footnotes/Additional Requirements:

1. *Mounting Heights shall also comply with ADA and ICC/ANSI 117.1*
2. *Mounting Heights shall also comply with prevailing Building Code and Fire Codes.*
3. *Deviation of from listed height will be allowed up to + 1-1/2 IN provided this does not cause a conflict of between the lock and lite cutouts.*

F. Install hardware with fasteners concealed where not required by code to be exposed.

G. Coordinate installation of electric access control hardware.
   1. Hardware installer to be responsible for coordination with electrical installer for low voltage installations.

H. Door Position Switches (DPS):
   1. Coordinate door and frame preparations with door and frame suppliers, and Security System installer as appropriate.
   2. Locate in frame head approximately 4 IN from latching door edge, unless otherwise instructed.

3.3 ADJUST AND CLEAN

A. Adjust and check each operating item of hardware to ensure proper operation or function.
   1. Lubricate moving parts with lubricant recommended by manufacturer.
   2. Replace units which cannot be adjusted and lubricated to operate smoothly.

B. Conversion of Construction Keying to Permanent (by Contractor):
   1. Convert cylinders from Construction to Permanent configuration at time of Substantial Completion.
   2. Demonstrate conversion method to Owner’s facility personnel, making certain Owner’s team understands methodology.

C. Approximately six months after substantial completion, check and readjust to assure proper function of doors and hardware.
   1. Clean and lubricate operational items.
   2. Replace items which have deteriorated or failed.
   3. Prepare a written report of current and predictable problems in operation of hardware.
   4. Report visit and furnish copy of report to Owner with copy to Architect.

D. When hardware is installed more than one month prior to final acceptance or occupancy, during week prior to acceptance or occupancy, make a final check and adjustment of hardware items.
   1. Remove temporary coverings.
   2. Clean and lubricate as necessary to assure proper function and finish.
   3. Adjust door control devices to compensate for operation of heating and ventilating equipment.

E. Instruct Owner's personnel:
   1. Operating and maintenance procedures.
   2. Key control system.
   3. Methodology used to re-key cylinders from Construction to Permanent configuration.

F. Prior to substantial completion instruct Owner's personnel in systems operation.
   1. Standard system operation and maintenance.
   2. Modification of codes.
   3. Acquisition, monitoring and scheduling of ID cards.
   4. Instruction in software applications.

END OF SECTION

SECTION 08 81 04
INTERIOR GLASS AND GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Interior Glass and Glazing in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Glass Standards:
   1. ANSI Z97.1.
   2. CPSC 16 CFR 1201.
   3. GANA Glazing Manual.

B. Flat Glass ASTM C1036.
   1. Float glass: Type I, Quality q3 and Class 1 unless otherwise indicated.
   2. Figured glass: Type II, Quality q7, Form 3 and Class 1, Finish f1 and Pattern p2 unless otherwise indicated.
   3. Mirror glass and one-way vision glass: Type I, Quality q1 or q2, Class 1 and coated for purpose.

C. Flat Glass, Heat Treated, Coated and Uncoated, ASTM C1048.
   1. Heat strengthened glass: Kind HS, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.
   2. Tempered glass: Kind FT, Type I, Quality q3, Class 1 and Condition A unless otherwise indicated.

D. Mirror Glass:
   1. ASTM C1503;
   2. Quality: Mirror select.
   3. F.S.DD-M-00411B (1).

E. Fire-Rated Assemblies:
   1. General:
      a. Where glazing products are used in fire-rated assemblies, comply with requirements of specific assembly specified in other sections of these Specifications.
      b. Underwriters Laboratories, Inc. (UL):
         1) UL 9 – Fire Tests of Window Assemblies.
         2) UL 10B – Fire Tests of Door Assemblies.
         3) UL 10C – Positive Pressure Fire Tests of Door Assemblies.
      c. Fire Protective Rated Glass: Each lite shall bear permanent, non-removable label of UL certifying it for use in tested and rated fire protective assemblies.
   2. Door Assemblies:
      a. Complying with NFPA 80 and listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 252.
      b. Positive Pressure Compliance: UL 10C.
      c. Fire Protective Glazing Products for Door Assemblies: Products identical to those tested per UL 10B, labeled and listed by UL.

3. Window Assemblies:
    a. Complying with NFPA 80 that are listed and labeled by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire ratings indicated, based on testing according to NFPA 257.
    b. Positive Pressure Compliance: UL 10C.

F. Laminated Glass:
1. ASTM C1172 Standard Specification for Laminated Architectural Flat Glass.
2. Laminated Glass Design Guide, by the Glass Association of North America (GANA).

G. Glazing Standards:
1. Glazing Manual, by the Glass Association of North America (GANA).

1.3 SUBMITTALS

A. Samples:
1. Provide one (1) 4 IN x 4 IN example of each specified type of glass.

B. Contract Closeout Information:
1. Warranties.

1.4 WARRANTY

A. Written warranty signed by manufacturer or fabricator.

B. Laminated Glass:
1. Five (5) years against deterioration including edge separation, delamination that materially obstructs vision through glass, and blemishes exceeding those allowed by referenced laminated-glass standard.

C. Fire-rated Ceramics:
1. Five (5) year manufacturer's standard warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Glass Products:
1. Base:
    a. AGC Industries.
2. Optional:
    a. Guardian Industries.
    b. Pilkington.
    c. PPG Industries.
    d. Saint-Gobain.

B. Fire-rated Glass Ceramic:
1. Base:
    a. Technical Glass Products.
2. Optional:
    a. Safti First.
    b. Pilkington.
    c. Saint-Gobain.

2.2 MATERIALS

A. Glass Materials:
1. Comply with indicated standards.
2. See Glass Types Schedule for listing of types.
3. Materials specified in Glass Types Schedules are minimum acceptable products.

4. Single manufacturer produce individual glass types used in fabrication of insulating units.
5. Manufacturer or fabricator determine if materials should be heat strengthened or fully tempered at non-hazardous locations that do not require safety glazing and provide accordingly.

B. Glazing Compounds:
1. Nonsag, nonstain type.
2. Pigmented to match frame units not requiring painting.
3. Compatible with adjacent surfaces.
4. For use in setting glass: Neutral-cure Silicone sealant.
5. Sealant tape:
   a. Butyl rubber sealant tape or ribbon having a continuous neoprene shim.
6. Gaskets:
   a. Polyvinyl chloride or neoprene.
   b. Extruded, flexible, of profile and hardness required to receive glass and provide a watertight installation.

C. Installation Setting Blocks and Spacers:
1. Neoprene, compatible with sealants used.
2. Setting blocks: 80-90 durometer.
3. Spacers: 40-50 durometer.
4. Compressible filler stock: Closed cell jacketed rod stock of synthetic rubber or plastic foam.
5. Shims, clips, springs, angles, beads, attachment screws and other miscellaneous items: As indicated or required.

2.3 GLASS TYPES SCHEDULE

A. Refer to Interior Glass Types Schedule for basic description of Mark Numbers indicated on Drawing.

B. Refer to Drawings for depiction of unit sizes and locations.

C. Upgrade basic type conditions in accordance with following rules:
1. Heat treatment upgrade based on physical size of unit:
   a. Heat strengthened or fully tempered units between 55 and 70 SF.
   b. Fully temper units exceeding 70 SF.
   c. Strengthen annealed glass where units exceed length or width limitations or both as recommended by glass manufacturer.
2. Heat treatment upgrade based on locations which are potentially hazardous to occupants:
   a. Upgrade units to fully tempered, Kind FT, glass as required by any one of following:
      1) When required by local Codes.
      2) When specifically indicated on Drawings.
      3) Locations requiring Safety Glass, Kind FT, by 16 CFR 1201 and ANSI Z97.1:
         a) Units installed in doors, sash, transom or other operable units.
         b) Units where any part of unit is within 18 IN, measured vertically, above a floor line, sidewalk, paver, or other walking surface located within 3 FT of the glass unit, measured horizontally.
      4) Units in sidelights and other units located adjacent to and within 48 IN of either jamb of door or other operable units; this includes adjacent lites that are in perpendicular plane to door.
3. Other conditions requiring heat treatment upgrades:
   a. Units which will be exposed to irregular sun or shade combinations or both shall be Kind HS or better.
   b. Where glass manufacturer recommends heat treatment coatings or tints specified.
   c. Where required to resist lateral loads.

2.4 INTERIOR GLASS TYPES SCHEDULE

A. **Type A** - Annealed:
   1. Clear float, 6mm (1/4 IN) thick.

B. **Type T** - Tempered:
   1. Clear, fully-tempered tongue-less float, 6mm (1/4 IN) thick.

C. **Type C8** – 8mm, Laminated Fire and Safety Glass:
   1. Laminated, wireless, UL labeled for assembly indicated.
   2. Impact-Safety Rated per ANSI Z97.1 and CPSC 16CFR1201.
   3. Thickness: 8mm (5/16 IN), laminated.
   4. Surface: Polished.
   5. Base Product: FireLite Plus by Technical Glass Products.

D. **Type M** – Mirror Glass:
   1. Color: Clear.
   2. Thickness: 6mm (1/4 IN).
   3. Unit Length and Width: As indicated on drawings.
   4. Annealed

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

3.2 INSTALLATION

A. Do not install glass with edge damage.

B. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.

C. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.

D. Comply with GANA Glazing Manual.

E. Install sealants as recommended by sealant manufacturer.

F. Install setting blocks in adhesive or sealant.

G. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.

H. Minimum Bite:
   1. Monolithic, 6mm (1/4 IN) glass: 3/8 IN minimum bite.
   2. For other sizes: Refer to Table C of AAMA's Aluminum Curtain Wall Design Manual, Volume 6, Glass and Glazing.

I. Sealant Depth: Equal to sealant width.

J. Prevent sealant exudation from glazing channels.
   1. Leave void at heel or install filler at jambs and head.
   2. Do not leave void or install filler at sill.

K. Miter cut and bond gasket ends together at corners.

L. Immediately after installation, attach crossed streamers to framing held away from glass.

M. Do not apply anything to surfaces of glass.

N. Installation of Mirrors:
   1. Mastic Attachment: Install mirrors with mirror adhesive applied to back of mirror and pressed against substrate as recommended by mirror supplier.

O. Remove and replace damaged glass.

3.3 CLEANING AND PROTECTION

A. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.

B. Comply with glass manufacturer's recommendations and GANA 01-0300.

END OF SECTION

SECTION 08 88 35
SEALED GLASS UNITS WITH OPERABLE LOUVERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Sealed Glass Units with Operable Louvers, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM E2190 Standard Specification for Insulating Glass Unit Performance and Evaluation.
   2. ASTM E2188 Standard Test Method for Insulating Glass Unit Performance.
   3. ASTM E2189 Standard Test Method for Testing Resistance to Fogging in Insulating Glass Units.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Showing complete installation details.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Sealed Glass Units with Operable Louvers (SGU):
   1. Base:
      a. Unicel Architectural.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Base Product: Vision Control by Unicel Architectural.

B. Schedule of Configurations:
   1. SGU Type ___:
      a. Outboard light: 1/4 IN thick, clear, tempered (Kind FT).
      b. Air Space: 2 IN wide, dehydrated air space between the two glass lites.
      c. Inboard light: 1/4 IN thick, clear, tempered.
      d. Total Thickness of SGU: 2-1/2 IN.

C. Spacer:
   1. Corrosion-resistant aluminum spacers 2 IN wide.
   2. Turned into frames by mechanically locked corner keys.
   3. Fill with desiccant in precise proportions.
   4. Minimum dew point: -73 degF and a moisture-free air space.
   5. Finish: Baked-enamel.
      a. Color: White.

D. Edge Seal:
   1. Primary Seal: Compressed polyisobutylene.
   2. Secondary Seal: Polysulfide.

3. General: The contact of both sealants shall provide perfect adhesion as well as insurance against moisture, vapor penetration, resistance to the effects of solvents and oils, and infiltration of any substance.

E. Concealed Louvers:
1. Blades:
a. Extruded, 6063 T-5 aluminum, hollow-chambered profile with
b. Blades overlap when closed.
c. Blade Width: 1-3/8 IN.
d. Blade Thickness: 1/4 IN.
e. Blades secured at both ends with molded pivots.
f. Cords or strings: Not permitted.
2. All pivots, pinions, and racks shall be made of UV-stabilized materials to ensure dimensional stability, durability, and maintenance-free service never needing lubrication.
3. The blades shall rotate 180 degrees in a continuous cycle.
4. Blade Orientation:
a. Horizontal.
5. Finish: Baked-enamel.
a. Color: White.

F. Manual Operation:
1. Crank Handle:
a. Rotation of the blades controlled by:
1) Single standard crank handle.
b. Handle Color:
1) White.
2. Thumbwheel:
a. Rotation of the blades controlled by:
1) Plastic thumbwheel operator, accessible on one side.
b. Thumbwheel Color:
1) White.

2.3 FABRICATION

A. Clearly mark fabricated units to indicate the side exposed to the exterior, corridor or vestibule.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine framing or glazing channel surfaces, backing, stop design, and conditions under which glazing is to be installed.

B. Field verify openings scheduled to receive glass units.

C. Fabricate to measured sizes.

3.2 PREPARATION

A. Prepare openings to receive sealed glass units.

B. Do not install glass with edge damage.

C. Contractor is responsible for correct glass size for each opening, within tolerances and dimensions established.

D. Comply with recommendations of manufacturers, except where more stringent requirements are indicated.

E. As a minimum, comply with GANA Glazing Manual and IGMA Glazing Guidelines for Sealed Insulating Glass Units.

F. Install sealants as recommended by sealant manufacturer.

G. Install setting blocks in adhesive or sealant.

H. Provide spacers inside and out, of proper size and spacing, for glass size, except where gaskets are used for glazing.

I. Minimum Bite: 1/2 IN.

J. Sealant Depth: Equal to sealant width.

K. Immediately after installation, attach crossed streamers to framing held away from glass.

L. Do not apply anything to surfaces of glass.

M. Remove and replace damaged glass.

3.3 CLEANING AND PROTECTION

A. Maintain glass reasonably clean during construction, so that it will not be damaged by corrosive action and will not contribute to deterioration of other materials.

B. Wash and polish glass on both faces not more than 7 days prior to final completion of work in each area.

C. Comply with glass manufacturer's recommendations and GANA 01-0300.

END OF SECTION

SECTION 08 88 53
SECURITY GLAZING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Security Glazing in accordance with provisions of the Contract Documents.

B. This Section includes:
   1. Glass and glazing for security hollow metal frames, security hollow metal doors, and other detention equipment.
   2. Glass and glazing for detention windows, types as indicated.
   3. Glass and glazing for detention equipment, types as indicated.
   4. Glass and glazing for security hollow metal entrance doors and store front sidelights.

C. Related Sections include:
   1. 11 19 00: Detention Hardware and Equipment: Supply and installation of security doors, relite frames, and other equipment requiring security glass and glazing, except as otherwise specified.
   2. 08 34 63: Detention Hollow Metal.

D. Completely coordinate with work of other trades.

1.2 REFERENCE STANDARDS

A. Conduct work in accordance with OSHA and EPA requirements.

B. National Fire Protection Association (NFPA):
   1. NFPA 241 Standards for Safeguarding Construction, Alteration, and Demolition Operations.

C. Use only firms or individual trades qualified to perform work required under this section.

D. American National Standards Institute (ANSI)
   1. ANSI Z97.1- Performance Specifications and Methods of Test for Safety Glazing Material used in Building.

E. American Society for Testing and Materials (ASTM)
   1. ASTM C1036 –Flat Glass
   2. ASTM C1048 – Heat-Treated Flat Glass –Kind HS, Kind FT, coated and uncoated glass.
   3. ASTM E773 – Test Method for Durability of Sealed Insulating glass units.
   4. ASTM E838 – Cracking, Blistering, Crazing, and Color Changes.
   5. ASTM F1233 – Test Method for Security Glazing Materials and Systems.
   6. Consumer Product Safety Commission (CPSC)
      a. CPSC 16CFR 1201 – Safety standards for glazing Materials.
   7. H.P. White TP .0500 Ballistic standard
   8. H.P. White TP .0500 Forced entry standard
   9. Walker, McGough, Foltz, and Lyera (WMFL)
      a. WMFL (Levels 1-3) forced entry procedures plus ballistics.
   10. Federal Specifications (FS)
      a. FS TT-S-230A – Sealing Compound, Synthetic rubber base, single component (for caulking, sealing, and glazing in buildings and other structures.
      b. FS TT-S-002303 – Sealing compound, Elastomeric type, single component (for caulking, sealing, and glazing in buildings and other structures.
      c. FS MIL-P46144 – Polycarbonate and plastic sheet standards.
   11. Flat Glass Marketing Association (FGMA)
      a. FGMA – Glazing Manual
      b. FGMA – Sealant Manual

1.3 SUBMITTALS

A. Product Data, Samples, Shop drawings and Certification: Submit in accordance with Section 01 34 0.

B. Product Data: Submit manufacturer's descriptive literature and technical data including:
   1. Instructions for handling, storing, installation, and recommended Procedures for cleaning of each type of glass and glazing material.
   2. Provide structural, physical and environmental characteristics and Size limitations of each type of glass and glazing material.
   3. Provide chemical, functional, and environmental characteristics, limitations, special application requirements. Identify available colors.

C. Samples – Submit to job site, prior to delivery of materials, samples of each of the following:
   1. One 12 inch x 12 inch piece of each type of glass in required thickness.
   2. One bead, approximately ¼" wide by 3 inches long, of each sealant to be used, indicating color of cured material.

D. Certificate of Compliance: Documentation of compliance with Specification Requirements.

E. Certificate of Compatibility: Documentation of compatibility of sealants with Glazing products.

1.4 QUALITY ASSURANCE

A. Manufacturer qualifications: Company specializing in the manufacture of Security glass, types a specified, with minimum documented (5) years experience.

B. Glazier qualifications: Company specializing in the manufacture of security Glass products, similar types as specified, with minimum documented (5) years experience.

1.5 WARRANTY

A. Provide manufacturer's written warranty for a period of not less than (5) years.

B. Provide a published and written warranty signed by manufacturer, agreeing to furnish F.O.B. point of manufacture, freight allowed to project site, within 45 working days after receipt of notice from Owner for replacement of those units which develop manufacturing defects.

C. Definitions: manufacturing defects are defined as edge separation, seal failure, delamination, core cracking, loss of visability/clarity due to dusting or misting, or UV exposure, or chemical reaction to glass cleaners.

D. All glass clad laminates are fabricated and cut to size. Alteration of material after it is produced voids the stated warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Security Type Glass:
   1. Base:
      a. Insulgard, Inc. Nazareth, PA
      b. Custom Glass Corp., Kittaning, PA
      c. Globe Amerada Corp., Selma, AL

B. Glazing Materials:
   1. Base:
      a. Tremco

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DETENTION GLASS – SECURITY GLASS TYPES

A. SG-2 9/16 inch (nominal thickness) Clear chemically strengthened glass-clad polycarbonate Equal to Sure-Gard ICGCP916. Product must meet H.P. White TP .500 forced entry level 1 and level A ballistics.
   1. 1/8” chemically strengthened glass
   2. urethane interlayer
   3. ¼” polycarbonate
   4. urethane interlayer
   5. 1/8” chemically strengthened glass

B. SG-3 11/16 inch (nominal thickness) Clear chemically strengthened glass-clad polycarbonate Equal to Sure-Gard ICGC1116. Product must meet H.P. White TP .0500 forced entry level 2 and B ballistics.
   1. 1/8” chemically strengthened glass
   2. urethane interlayer
   3. 3/8” polycarbonate
   4. urethane interlayer
   5. 1/8” chemically strengthened glass

2.3 BALLISTIC GLASS TYPES

A. BR-1M:
   1. Nominal thickness 1.5” Nominal, clear, UL Level III (3 shots .44 mag) listed, with LOF Mirrorpane on #1 surface. Glazing SecurTem+Poly SP-311M (basis of design) or pre-bid approved equal.
   2. Mirror requires an 8:1 lighting ratio. Product must be installed with polycarbonate spall protection to the protected face.
   3. Edge engagement: 1” with ¼” setting blocks for overall glazing pocket of 1-1/4” deep.
   4. Compatible (with polycarbonate) materials include, but not limited to: Setting blocks: Thermoplastic rubber or Santoprene (silicone) available from CR Laurence, glazing tape: Tremco 440 or Polyshim II, silicone: Dow 795, GE Silpruf.

2.4 DESCRIPTION/FABRICATION

A. Chemically strengthened glass shall have a modulus of rupture range of 20,000 to 28,000 PSI.

B. Laminated compositional security sheet products:
   1. Glass: Refer to primary chemically strengthened glass requirements as related to properties of coated and uncoated glass making up laminated security glass.
   2. Interlayer: Provide laminators standard interlayer sheet (not poured from resin) for laminating glass with a polycarbonate core, with a proven record of showing no tendency to bubble, discolor or lose physical or mechanical properties after laminating and installation.
   3. Plastic core: Refer to appropriate product requirements relating to Properties of polycarbonate making up the laminate security product.
   4. Laminating Process: Fabricate laminated sheets using laminator’s Standard process to produce products free from foreign substances and air bubbles.
   5. Glazing is fabricated to size. Only laminates using chemically strengthened glass may be cut by the mfg. after fabrication without voiding the warranty.

2.5 GLAZING MATERIALS

A. Compatibilty: Select material with proven record of compatibility with Surfaces contacted in each application.

B. Sealant: Single component acrylic terpolymer, FS TT-S00230: “Tremco Mono”, color as later selected by Architect.

C. Glazing tape: Preformed butyl, NAAMM #55-1B-68, with integral resilient tube spacing device; 10-15 Shore A hardness; coiled on release paper; color as later selected by Architect.

D. Setting/Edge Blocks: Stanoprene or blocks as required for compatability with glazing sealants, 70-90 Shore A durometer Hardness; of size and shape recommended by glass and sealant Mfg.

PART 3 - EXECUTION

3.1 INSPECTION

A. Check that glazing channels are free of burrs, irregularities, and debris.

B. Check that glass is free of edge damage or face imperfections.

C. Do not proceed with installation until any unsatisfactory conditions are Corrected.

3.2 PREPARATION

A. Field Measurements:
   1. Cut glass accurately to sizes obtained from verified field measurements of frames.
   2. Allow for proper edge clearances.

B. Preparation of surfaces:
   1. Remove any protective coatings or covering from surfaces to be glazed.
   2. Clean glass and glazing surfaces to remove dust, oil, and contaminants. Then wipe dry.

3.3 INSTALLATION

A. General Requirements: All materials shall be used in accordance with the Manufacturer's printed instructions and recommended procedures.

B. Positioning of glass:
   1. Orient pattern, and draw of glass in same direction.
   2. Place glass waves parallel to floor.

C. Clearance requirements: Allow the following minimum nominal clearances, in accordance with glass manufacturer's recommendations: glass face to Channel face, glass edge to frame member, and glass bite.

Glass Bite	Face Clearance	Edge Clearance
1 inch	1/8 inch	¼ inch

3.4 EXTERIOR COMBINATION METHOD (TAPE AND SEALANT)

A. Cut glazing tape to proper lengths prior to application, install Permanent stop, 3/16" to ¼" below sightline.

B. Do not lap the adjoining lengths of tape or rubber shim, as this will prevent full Contact around perimeter of glass.
   1. Strips must be installed in 4 separate sections, not run continuously around corners.

C. Place setting blocks at ¼ points.

D. Rest glass on setting blocks and press against tape with sufficient pressure to ensure full contact and adhesion at perimeter.

E. Install removable stops; insert continuous spacer strips between glass and applied stop to keep glass in compression against the tape.

F. Sealant cavity pocket, formed by setting of the applied stop, shall then be filled to the sight line.

G. Cap bead shall not exceed 1/16 inch above sight line onto glass surface.

H. Tool or wipe cap bead with solvent for smooth appearance.

3.5 INTERIOR DRY METHOD (TAPE AND TAPE)

A. Cut glazing tape to length and install against permanent stop, projecting 1/16 inch above sight line.

B. Place setting blocks at ¼ points.

C. Rest glass on setting blocks and press against tape with sufficient pressure to ensure full contact and adhesion at perimeter.

D. Place glazing tape on free perimeter of glass in same manner described above.

E. Install removable stop, avoid displacement of tape, exert pressure on tape for full continuous contact.
   1. Knife trim excess or protruding tape.

3.6 CLEANING AND PROTECTION

A. Cleaning
   1. Remove excess glazing material from installed glass.
   2. Remove labels from surfaces as soon as installed.
   3. Remove debris from work site.

B. Protection
   1. Attach crossed streamers away from glass face.
   2. Do not apply markers to glass surface.
   3. Replace damaged glass.

END OF SECTION

DIVISION 09

FINISHES

SECTION 09 22 16
NON-STRUCTURAL METAL FRAMING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Non-Structural Metal Framing in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Member of Certified Steel Stud Association (CSSA), Steel Stud Manufacturers Association (SSMA) or Steel Framing Industry Association (SFIA).

B. ASTM International (ASTM):
   1. ASTM A653 Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process
   2. ASTM C645 Standard Specification for Nonstructural Steel Framing Members.
   3. ASTM C754 Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products.
   4. ASTM A1003 Standard Specification for Steel Sheet, Carbon, Metallic and Nonmetallic-Coated for Cold-Formed Framing Members.

C. Provide studs and accessories of type tested and listed for construction indicated.

1.3 SUBMITTALS

A. Product Data:
   1. Provide copies of manufacturer's specifications and installation instructions for each type of material and accessory required.
      a. Where fire resistance classification is indicated, submit copies of nationally recognized testing laboratory listings of products proposed for use.
      b. Include data required to show specification compliance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Non-structural Metal Framing:
   1. Base:
      a. Telling Industries
   2. Optional:
      a. CEMCO Steel Framing and Metal Lath
      b. ClarkDietrich Building Systems
      c. Custom Stud Inc.
      d. Marino/WARE
      e. MRI Steel Framing LLC.
      f. The Steel Network

B. Isolation Strip Material:
   1. Base:
      a. Reflectix, Inc.

2. Optional:
   a. Saint-Gobain

C. Partial Height Wall Support:
   1. Base:
      a. The Steel Network

D. Interlocking Grid Support Systems for Gypsum Board Ceilings:
   1. Base:
      a. USG Corporation
   2. Optional:
      a. Armstrong
      b. Chicago Metallic

E. Other manufacturers desiring approval comply with Section 00 26 00.

F. Products proposed for use in fire-rated assemblies:
   1. Approved by nationally recognized testing laboratory.

2.2 DESIGN CRITERIA

A. Select steel studs in accordance with manufacturer's standard load tables and following design pressures and maximum deflections:

PERFORMANCE CRITERIA		
Use Condition [2]	**Design Pressure**	**Maximum Deflection**
Wall enclosing stairs, elevator hoistways, and other vertical shafts	10 LBS/SF	L/120
Wall enclosing vestibules, ground floor lobbies, and similar spaces subject to intermittent exposure to exterior wind conditions	15 LBS/SF	L/240
Walls scheduled with Tile Backer Board, Moisture-resistant, or Abuse-Resistant Gypsum Wallboard	5 LBS/SF	L/360
Walls scheduled to receive Tile, lath and plaster, or veneer plaster. [1]		
Typical Interior Walls/Partitions (those not listed above)	5 LBS/SF	L/240
Interior Ceilings, Soffits and Bulkheads	5 LBS/SF	L/360

Footnotes:
1. Limit deflection to L/360 where wall cladding on either face is any of the following: Ceramic Tile, Stone Tile, Porcelain Tile, Thin Brick, Lath & Plaster, Simulated Masonry, Adhered-stone, Veneer Plaster and similar brittle finishes which are prone to movement-induced cracking.
2. Where elements meet multiple conditions; Use most stringent Deflection and Design Pressure values.

2.3 MATERIALS

A. Metal Studs and Floor Tracks:
   1. C-shaped studs and tracks roll-formed from corrosion-resistant galvanized steel conforming to ASTM C645.
   2. Galvanized: ASTM A653, G40.
   3. Stud and track depths: As indicated by wall type.
   4. Minimum flange width: 1-1/4 IN.
   5. Minimum thickness: 18 mil (25 GA), except as follows:
      a. Provide heavier thickness to comply with performance criteria.
      b. Upgrade framing members to minimum 30 mil (20 GA) studs at following conditions:
         1) At jambs of openings: Two 30 mil (20 GA) studs.
         2) One or both sides of partition will be faced with any of following:

a) Wall mounted cabinetry and equipment.
b) Tile backing board.
c) Adhered stone.
d) Plaster.
e) Abuse-resistant wallboard.

3) Where partitions do not extend to overhead structural deck, and without supporting diagonal bracing, or horizontal stiffeners.

c. Provide heavier thickness where specifically indicated.

6. In lieu of greater stud thickness, design may employ diagonal braces above ceiling to reduce overall span and thus stiffen wall frame.
   a. Coordinate locations with building services items.
   b. Do not employ studs with stud thickness less than allowed by fire resistance-rated assemblies.
7. High strength 50KSI studs shall comply with design criteria of equivalent thickness standard 33KSI studs listed.
8. Base products:
   a. Drywall Framing System by Telling Industries.
9. Optional products, high strength steel:
   a. Viper Stud by Telling Industries.

B. Head of Wall Accessories:
1. Configure to accommodate deflection of superstructure without inducing axial loading on partition wall.
2. Maintain structural integrity, fire and smoke-resistance, and sound control as required by each wall.
3. Slotted top deflection track:
   a. Deep leg, vertically slotted track.
   b. Cold-formed sheet steel; galvanized; ASTM A653 G60.
   c. Thickness: 30 mil (20 GA) minimum.
   d. Width: As required for studs sizes indicated.
   e. Depth: Minimum 2-1/2 IN down-standing legs with 1/4 IN wide by 1-1/2 IN high slots spaced 1 IN on center.
4. Z-bars, cold formed channels and clips:
   a. Accommodate thickness of spray-applied fire-resistive materials.
5. Fasteners suitable for attachment to superstructure.
6. UL-listed fire resistant components tested for compliance with requirements indicated.
7. Firestopping Materials:
   a. Sealants, sprays, intumescent strips and forming materials.
   b. Coordinate with sealants specified in Section 07 84 00 and Section 07 92 16.
   c. Intumescent applications:
      1) Factory or field applied.

C. Furring Channels:
1. Hat-shaped sections.
2. Galvanized: ASTM A653, G40.
3. Sizes: 7/8 IN and 1-1/2 IN, as indicated.
4. Minimum Thickness: 30 mil (20 GA); Use heavier gauge as dictated by conditions.
5. Base product: DWFC by Telling Industries.

D. Z-Furring:
1. Z-shaped sections, attached to structural parent wall.
2. Galvanized: ASTM A653, G40.
3. Sizes: 1, 1-1/2, 2 and 2-1/2 IN, as indicated.
4. Thickness: 18 mil (25 GA) minimum.; Use heavier gauge as dictated by conditions.
5. XPS foam insulation: Specified in Section 07 21 00.
6. Base product: ZFC by Telling Industries.

2.4 ACCESSORY ITEMS

A. Wire Ties:
   1. Minimum thickness: 43 mil (18 GA) soft annealed, galvanized.

B. Track Fasteners:
   1. Power driven type, to withstand minimum 190 LB shear when driven.

2.5 SUPPORT SYSTEMS FOR GYPSUM CEILINGS

A. Interlocking Grid Systems:
   1. ASTM C635, direct-hung system composed of T-Shaped framing members designed to carry load of screw-applied gypsum ceiling board.
   2. Tabs on Cross-Tees to interlock into slots in Main Runners where intersections occur.
   3. Base Product: Drywall Suspension System by USG Corporation.

B. Track and Channel Systems:
   1. ASTM C645 roll-formed steel with G40 galvanized coating.
   2. Thickness: 30 mil (20 GA) minimum; Use heavier gauge as dictated by conditions.
   3. Carrying channels:
      a. Size: 1-1/2 IN.
   4. Furring channels:
      a. Sizes: 7/8 and 1-1/2 IN, as indicated.

C. Stud-Framed Ceiling/Soffit Systems:
   1. C-shaped studs or joists; roll-formed from corrosion-resistant galvanized steel that conforms to ASTM C645.
   2. Galvanized Coating: ASTM A653, G40.
   3. Frame member depth: 3-5/8 IN minimum, unless otherwise indicated.
      a. Use wider stud sections if ceiling span and support requires.
   4. Flange width: 1-1/4 IN minimum.
   5. Stud thickness: 33 mil minimum.

D. Tie Wire:
   1. ASTM A641, Class 1 zinc coating, soft temper.
   2. Diameter, single-strand: 62 mils (14 GA) minimum.
   3. Diameter, double-strand: 42 mils (18 GA) minimum.

E. Wire Hangers:
   1. ASTM A641, Class 1 zinc coating, soft temper.
   2. Diameter: 97 mils (12 GA) minimum.

F. Anchors in Concrete:
   1. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512 as applicable.
   2. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.
   3. Material: Carbon-steel components zinc plated to comply with ASTM-B633, Class Fe/Zn 5 for Class SC 1 service condition.

G. Power-Actuated Fasteners in Concrete:
   1. Fastener system of type suitable for application indicated, fabricated from corrosion-resistant materials, with clips or other accessory devices for attaching hangers of type indicated, and with capability to sustain, without failure, a load equal to 10 times that imposed by ceiling construction, as determined by testing per ASTM E1190.

H. Other items including suspension wire, tie wire, attachment devices: As specified and indicated.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine supporting structure and conditions under which system will be installed.

B. Correct conditions detrimental to proper installation.

C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION - GENERAL

A. Layout and install metal framing accurate to dimensions indicated in drawings.

B. Installation Standard: ASTM C754, except comply with framing sizes and spacing indicated.
   1. Gypsum Board Assemblies: Comply with additional requirements in ASTM C840 relative to framing installation.

C. Install supplementary framing, and blocking to support fixtures, equipment services, heavy trim, grab bars, toilet accessories, furnishings, or similar construction.

D. Install bracing at terminations in assemblies.

E. Do not bridge building control and expansion joints with non-load-bearing steel framing members. Frame both sides of joints independently.

F. Where studs are installed directly against exterior masonry walls or dissimilar metals at exterior walls, install isolation strip between studs and exterior wall.

G. Extend framing full height to structural supports.
   1. Exception: Where partitions are indicated to terminate at, or just above, suspended ceilings.
   2. Continue framing around ducts and similar items which penetrate partitions.

H. Utilize slip-type head track assemblies where framing extends to overhead structural supports.
   1. Configure to resist lateral loads while accommodating deflection of overhead building superstructure without inducing axial loading on partition framing.

I. Size floor tracks and head track assemblies to match studs.
   1. Align floor track and deflection track.
   2. Secure floor track and deflection track to structure in accordance with manufacturer's instructions and regulatory requirements.
   3. Secure at corners and at ends.

J. Position studs vertically engaging floor track and head of wall deflection track.

K. Space studs maximum 16 IN on center.

L. Provide additional studs at corners, partition intersections and terminations of partitions, and at each side of control joints.

M. Positively anchor studs to floor tracks with self-tapping pan head screws, or stud clinching tool on both flanges of each stud.

N. Anchor studs to deflection track with wafer head screws on both flanges of each stud.
   1. Maintain deflection gap between top of stud and top of slotted track.
   2. Install screws at centerline of slot and secure allowing vertical movement.

O. Anchor fire rated partitions as required by fire resistance design, and firestopping design.

P. Align stud knockouts to facilitate running of wires and conduit.

Q. Where partitions abut vertical structural elements, provide perimeter relief per Gypsum Association GA-600, Figure 8.

R. Head-of-Wall:
   1. Provide slotted top track for walls extended to structure.
   2. Secure top track to superstructure with 0.145 IN x 1 IN powder actuated fasteners located 16 IN on center maximum.
      a. Pre-fit forming material that may be required as a part of a fire-resistive joint system.
   3. Where partitions attach to structural elements that are scheduled to receive Spray-applied Fire Resistive Materials (SFRM):
      a. Install Z-bar to underside of steel beams and steel deck before application of sprayed fireproofing.
      b. Locate Z-bars perpendicular to line of partition, spaced maximum 16 IN on center.
      c. Attach each Z-bar with two 0.145 IN x 1 IN powder-actuated fasteners located minimum 1 IN from ends of Z-bar.
      d. After fireproofing, secure top track to Z-bars with No. 8 x 5/8 IN wafer head framing screws spaced maximum 16 IN on center.
   4. Where fire-rated partitions are offset and will not clear fireproofed steel beam, extend Z-bar outrigger horizontally from bottom of beam out to minimum 2 IN beyond width of head-of-wall.
      a. Attach 3/4 IN expanded metal lath continuous, width of top of Z-bar outriggers prior to fireproofing steel beam to accommodate sprayed fireproofing.
   5. Cut vertical studs 5/8 IN short to create a deflection gap when installed into top track.
      a. Secure vertical studs to top track with No. 8 x 9/16 IN wafer head framing screw at each stud flange, screwing through track slots for positive stud connection.
   6. Secure Gypsum Wallboard to vertical studs; do not secure Gypsum Wallboard to top track directly.
   7. Prepare wall for installation of seals, firestopping, or both:
      a. Fire-rated Walls: Prepare for fire-resistive joint assemblies specified in Section 07 84 00.
      b. Non-fire rated partitions including Smoke Partitions: Prepare for Acoustical Sealant specified in Section 07 92 16.

S. Furring Channels:
   1. Install furring channel systems, directly attached to parent walls.
   2. Install channels at maximum 16 IN OC.
   3. Provide additional framing at openings, cutouts, corners, and control joints.
   4. Fasten to masonry walls with cut nails.
   5. Fasten to concrete with power driven fasteners.
   6. Space fasteners not more than 24 IN OC, staggered on opposite flanges of furring channels.

3.3 FRAMING AT OPENINGS

A. Control Joints (CJ):
   1. Install additional stud, maximum 1/2 IN from jamb studs.
   2. Do not fasten extra stud to track or jamb stud.
   3. Refer to specification Section 09 29 00 for control joint locations.

B. Prefabricated headers, jambs, and sill framing systems option:
   1. Proprietary opening framing systems may be considered as an alternative to conventionally fabricated framing.
   2. Pre-approved Products:
      a. HDS Framing System by ClarkDietrich.
      b. Quick Frame Rough Opening System by Marino/ Ware.

C. Door Openings:
   1. Screw vertical studs at jambs to jamb anchor clips on door frames; install runner track section for cripple studs at head and secure to jamb studs.
   2. Unless indicated otherwise, extend jamb studs through suspended ceilings and secure laterally to overhead structure.

3. Jamb Studs:
    a. Install two studs, toe-to-toe, at each jamb, unless otherwise indicated.
    b. Minimum thickness of jamb studs: 30 mil (20 GA) at openings.
    c. Securely attach jamb studs to door frames.
4. Headers:
    a. Openings less than 4 FT wide:
        1) Cut-to-length section of floor runner above and below wall openings.
        2) Split flanges and bend webs at ends.
        3) Overlap and screw attach jamb studs to frames.
    b. Openings over 4 FT wide:
        1) Cut-to-length, horizontal box beam studs above and below wall openings.
        2) Design for actual span and loading.
    c. Incorporate miscellaneous steel members, specified in Section 05 50 10, and wood blocking, specified in Section 06 10 53, where indicated.
5. Control Joints at head of jambs:
    a. Install cripple studs at head adjacent to each jamb stud, with a minimum 1/2 IN clearance from jamb stud to allow for installation of control joint in finished assembly.

D. Other Framed Openings:
1. Frame openings other than door openings the same as required for door openings, unless otherwise indicated.
2. Install framing below sills of openings to match framing required above door heads.
3. Headers and Sills:
    a. Openings less than 4 FT wide:
        1) Cut-to-length section of floor runner above and below wall openings.
        2) Split flanges and bend webs at ends.
        3) Overlap and screw attach jamb studs to frames.
    b. Openings over 4 FT wide:
        1) Cut-to-length, horizontal box beam studs above and below wall openings.
        2) Design for actual span and loading.
    c. Incorporate miscellaneous steel members, specified in Section 05 50 10, and wood blocking, specified in Section 06 10 53, where indicated.
4. Cripple Studs:
    a. Install cut-to-length intermediate vertical studs above and below openings.
    b. Spacing: As indicated for typical full-length studs.

3.4 WALL BACKING AND BLOCKING

A. Metal Wall Backing: Provide in-wall metal wall backing reinforcement where following items are mounted to interior walls and interior face of exterior walls:
1. Crash rails, chair rails, wall bumpers, and similar wall protection devices.
2. Contractor or Owner-furnished equipment indicated to be wall-mounted.
3. Toilet accessories that do not include proprietary backing devices.
4. Toilet partitions and lockers.
5. Markerboards, tackboards, and chalkboards.
6. Other wall-mounted items where backing is indicated by details or specification.

B. Wood Wall Blocking: Specified in Section 06 10 53.

C. Coordinate mounting height, location, and coverage with item to be supported.

D. Determine material width according to item to be supported.

E. Provide in-wall metal wall backing material to interior metal stud walls specified herein.

F. Attachment: Minimum 2 - #10 sheet metal screws at each stud.

3.5 INSTALLATION - CEILING

A. Install in compliance with manufacturer's recommendations.

B. Provide required items to support and trim out neatly, flush or recessed mechanical and electrical items.

C. Frame openings in ceiling support system to accommodate access panels and similar openings and penetrations.
   1. Completely frame openings with closed channel side of stud facing opening for support of recessed mechanical and electrical items.

3.6 INSTALLING CEILING SUPPORT SYSTEMS

A. Install suspension system components in sizes and spacings indicated on Drawings, but not less than required by referenced installation standards for assembly types and other assembly components indicated.

B. Isolate suspension systems from building structure where abutting or penetrated by building structure.

C. Suspend hangers from building structure as follows:
   1. Install hangers plumb and free from contact with insulation or other objects within ceiling plenum that are not part of supporting structural or suspension system.
      a. Splay hangers only where required to miss obstructions and offset resulting horizontal forces by bracing, counter-splaying, or other equally effective means.
   2. Where width of ducts and other construction within ceiling plenum produces hanger spacings that interfere with locations of hangers required to support standard suspension system members, install supplemental suspension members and hangers in the form of trapezes or equivalent devices.
      a. Size supplemental suspension members and hangers to support ceiling loads within performance limits established by referenced installation standards.
   3. Wire Hangers: Secure by looping and wire tying, either directly to structures or to inserts, eye screws, or other devices and fasteners that are secure and appropriate for substrate, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   4. Flat Hangers: Secure to structure, including intermediate framing members, by attaching to inserts, eye screws, or other devices and fasteners that are secure and appropriate for structure and hanger, and in a manner that will not cause hangers to deteriorate or otherwise fail.
   5. Do not attach hangers to steel roof deck.
   6. Do not attach hangers to permanent metal forms. Furnish cast-in-place hanger inserts that extend through forms.
   7. Do not attach hangers to rolled-in hanger tabs of composite steel floor deck.
   8. Do not connect or suspend steel framing from ducts, pipes, or conduit.

D. Grid Suspension Systems:
   1. Attach perimeter wall track or angle where grid suspension systems meet vertical surfaces.
   2. Mechanically join main beam and cross-furring members to each other and butt-cut to fit into wall track.
   3. Install suspension systems that are level to within 1/8 IN in 12 FT measured lengthwise on each member that will receive finishes and transversely between parallel members that will receive finishes.

END OF SECTION

SECTION 09 23 55
IMPACT RESISTANT GYPSUM PLASTER

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Impact Resistant Gypsum Plaster as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Perform no plastering at less than 55 degF.

B. Maintain adequate ventilation for curing.

C. Avoid differential drying and freezing.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer standard literature for listed products.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Impact Resistant Cement Plaster:
   1. Base:
      a. USG.

B. Plastering materials and Accessories:
   1. Base:
      a. USG.

C. Bonding adhesive:
   1. Base:
      a. Larsen Products.

D. Insulation:
   1. Base:
      a. Dow Corning.
      b. Pactiv Building Products.

E. Other materials:
   1. As noted.

F. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Plaster Base:
   1. 3/8 IN thick.
   2. Rocklath by USG.

B. Plaster:
   1. ASTM C587.

2. Base system minimum compressive strength: 2800 PSI.
3. Finish system minimum compressive strength: 5000 PSI.
4. Structo-Gage System by USG.

C. Sand: Per manufacturer's specifications.

D. Lime: Use ivory finish lime.

E. Water: Potable.

F. Joint Tape: Joint reinforcement tape.

G. Reinforcing Bars: 1/4 IN diameter G90, galvanized steel.

H. Reinforcing Attachment: Wall furring brackets.

I. Accessories: Standard zinc alloy for type of plaster.

J. Bonding Adhesive.
1. Larsen Products; Plaster-Weld.

K. Metal Lath: Self-furring type, galvanized.

L. Lath Attachment Clips: Birdjoint B-1, Brace-Tite field, and BT-1 starter.

M. Vapor Retarder: 6 mil polyethylene.

N. Insulation:
1. Extruded styrene foam.

O. Sealants:
1. For interior applications as specified in Section 07 92 16.
2. For exterior applications as specified in Section 07 81 24.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces to which plaster is to be applied.

B. Start of work constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION - INTERIOR BLOCK, TILE OR CONCRETE WALLS

A. Apply bonding agent to substrate.

B. Install reinforcing rods 24 IN OC both ways, with attachment clips.

C. Install metal lath continuous over substrate.

D. Fasten lath to substrate with anchoring to provide not over 2 SQ FT of plaster per fastener.

E. Install control joints at inside corners.

F. Apply plaster base coat to provide good keying thru metal lath to substrate.

G. Minimum thickness:
1. 1 IN on playing wall.
2. 7/8 IN on side walls.
3. 1/2 IN on ceiling.
4. Leave rough to receive finish coat.

H. Install finish coat to thickness of 1/16 IN, firmly bonded to base coat.

I. Finish: Steel trowel to dense, smooth finish, leveled to 1:1,000 tolerance.

J. Calk control joints.
   1. As specified in Section 07 92 16.

3.3 INSTALLATION - EXTERIOR BLOCK OR CONCRETE WALLS

A. Install vapor retarder continuous with taped joints.

B. Install Z furring 16 IN OC.

C. Install 2 IN thick insulation.

D. Install plaster base screwed to furring.

E. Install reinforcing rods 24 IN OC vertically and over every Z furring, with attachment clips.

F. Install metal lath continuous over substrate.

G. Fasten lath to substrate with anchoring to provide not over 2 SQ FT of plaster per fastener.

H. Install control joints at inside corners.

I. Apply plaster base coat to provide good keying thru metal lath to substrate.

J. Minimum Thickness:
   1. 1 IN on playing wall.
   2. 7/8 IN on side walls.
   3. 1/2 IN on ceiling.
   4. Leave rough to receive finish coat.

K. Install finish coat to thickness of 1/16 IN, firmly bonded to base coat.

L. Finish: Steel trowel to dense, smooth finish, leveled to 1:1,000 tolerance.

M. Calk control joints.
   1. As specified in Section 07 81 24.

3.4 INSTALLATION - INTERIOR STUD WALLS

A. Install plaster base screwed to studs.

B. Install metal lath continuous over substrate.

C. Fasten lath to substrate with anchoring to provide not over 2 SQ FT of plaster per fastener.

D. Install control joints at inside corners.

E. Apply plaster base coat to provide good keying thru metal lath to substrate.

F. Minimum thickness:
   1. 1 IN on playing wall.
   2. 7/8 IN on side walls.
   3. 1/2 IN on ceiling.
   4. Leave rough to receive finish coat.

G. Install finish coat to thickness of 1/16 IN, firmly bonded to base coat.

H. Finish: Steel trowel to dense, smooth finish, leveled to 1:1,000 tolerance.

I. Calk control joints.
   1. AS specified in Section 07 92 16.

END OF SECTION

SECTION 09 29 00
GYPSUM WALLBOARD

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Gypsum Wallboard in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International:
1. ASTM C475 Joint Compound and Joint Tape for Finishing Gypsum Board.
2. ASTM C840 Application and Finishing of Gypsum Board.
3. ASTM C841 Installation of Interior Lathing and Furring.
4. ASTM C954 Steel Drill Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
5. ASTM C1002 Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases.
6. ASTM C1047 Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base.
7. ASTM C1396 Standard Specification for Gypsum Board.
8. ASTM C1629 Abuse-Resistant Non-decorated Interior Gypsum Panel Products and Fiber-Reinforced Cement Panels.
9. ASTM D3273 Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber.
10. ASTM E84 Surface-Burning Characteristics of Building Materials.
11. ASTM E90 Sound Transmission Testing.
12. ASTM E119 Fire Tests of Building Construction.
13. ASTM E413 Classification for Rating Sound Insulation.
14. ASTM F2547 Standard Test Method for Determining the Attenuation Properties in a Primary X-ray Beam of Materials Used to Protect Against Radiation Generated During the Use of X-ray Equipment

B. Gypsum Association (GA):
1. GA-216 Application and Finishing of Gypsum Panel Products.
2. GA-234 Control Joints for Fire-Resistance Rated Systems.
3. GA-238 Guidelines for Prevention of Mold Growth on Gypsum Board.

C. Fire Resistant Rated Assemblies:
1. For fire-resistance-rated assemblies, provide materials and construction identical to those tested in assembly indicated according to ASTM E119 by an independent testing agency.
2. Provide materials listed by UL, or other approved testing laboratory, for construction and rating type indicated.

D. STC Rated Assemblies:
1. Provide materials and construction identical to those tested in assembly indicated according to ASTM E90 and classified according to ASTM E413 by an independent testing agency.

1.3 SUBMITTALS

A. Product Data:
1. Manufacturer’s specifications for each type of material and accessory.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Gypsum Wallboard:
   1. Base:
      a. Georgia Pacific (GP).
   2. Optional:
      a. American Gypsum.
      b. CertainTeed.
      c. National Gypsum Company (NGC).
      d. United States Gypsum (USG).

B. Drywall Trim Accessories:
   1. Base:
      a. United States Gypsum (USG)
   2. Optional:
      a. Bailey Metal Products
      b. ClarkDietrich
      c. Phillips Manufacturing

C. Specialty Drywall Trim:
   1. Base:
      a. Pittcon Industries.
   2. Optional:
      a. Fry Reglet Corp.
      b. Gordon, Inc.

D. Foam Tape:
   1. Base:
      a. As noted.

E. Sound Attenuation Batts (SAB):
   1. Base:
      a. As noted.

F. Preformed Acoustical Seal for Wall Boxes:
   1. Base:
      a. STC Architectural Products

G. Pressure-sensitive Fire Tape:
   1. Base:
      a. E-Z Taping System.

H. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 GYPSUM WALLBOARD (GWB) SCHEDULE

A. General:
   1. Utilize the following, in conjunction with Wall Types, Details, and Finish Schedule to determine types of wallboard appropriate to each condition.
   2. Furnish in maximum available lengths, consistent with installation requirements.
      a. Long Edge: Tapered.
      b. Short Ends: Square.
   3. Upgrade listed types to fire rated equivalent products when used in fire rated assemblies.
   4. Provide listed GWB products to mold-resistant types, where wallboard is installed in Electrical, Communication Rooms, Mechanical shafts, Stair Shafts and similar locations where wallboard is installed prior to building being weather-tight.

B. Interior Partitions and Ceilings:
   1. Gypsum panels - Standard:
      a. Thickness: 5/8 IN.
      b. Type X core for all locations.
      c. Base product:
         1) ToughRock Type X Gypsum Wallboard by Georgia Pacific.
   2. Tile Backer Board (TBB):
      a. Moisture resistant treated gypsum core, glass mats on both sides, and vinyl water barrier coating on finished side.
      b. Provide TBB at walls of showers, tub rooms, toilet rooms, decontamination rooms, and similar walls where tile is scheduled.
      c. Provide TBB at non-tile walls that will be continuously wet.
      d. Thickness: 1/2 IN.
      e. Thickness: 5/8 IN type X at rated walls.
      f. Mold-resistance score: 10 per ASTM D3273.
      g. Base Products:
         1) Non-Rated Walls: DensShield Tile Backer by Georgia Pacific.
         2) Fire Rated Walls: DensShield Fireguard Tile Backer by Georgia Pacific.
      h. Include Level 5 finish at non-tiled portions.
   3. Abuse Resistant Gypsum Wallboard (ARGWB):
      a. Thickness: 5/8 IN.
      b. Type X core.
      c. Mold-resistance score: 10 per ASTM D3273.
      d. Tested in accordance with ASTM C1629.
         1) Surface Abrasion: Level 2.
         2) Surface Indentation: Level 1.
         3) Soft Body Impact: Level 2.
      e. Upgrade metal studs to 20 GA minimum where used with ARGWB.
      f. Base product:
         1) ToughRock Abuse Resistant Gypsum Board by Georgia Pacific.

2.3 TRIM ACCESSORIES

A. Interior Trim:
   1. Material: Galvanized or aluminum coated steel sheet, rolled zinc, or paper faced galvanized steel sheet
   2. Shapes with tear-away base:
      a. Corner bead.
      b. LC-Bead: J-shaped; exposed long flange receives joint compound.
      c. L-Bead: L-shaped; exposed long flange receives joint compound.
      d. U-Bead: J-shaped; exposed short flange does not receive joint compound.
      e. Control joint.
      f. Curved-Edge Corner bead: With notched or flexible flanges.
      g. Other items as indicated.

2.4 JOINT TREATMENT MATERIALS

A. General:
   1. Use product types recommended by wallboard manufacturer for each condition.
   2. Materials compatible with other compounds applied previously or on successive coats.
   3. Provide dust control products in occupied areas or adjacent to occupied areas.

B. Joint Tape:
   1. Interior gypsum wallboard: Paper.
   2. Tile-backing panels: As recommended by panel manufacturer.

C. Joint Compounds for Interior Gypsum Wallboard:
   1. Setting-type joint compound:
      a. Filling open joints and voids.
      b. Embedding tape and first coat over joints, fasteners and trim flanges.
   2. Lightweight setting-type joint compound:
      a. Second coat.
      b. Final, skim coat on surfaces receiving a Level 5 finish.
   3. Drying-type all purpose joint compound:
      a. Second and third coats.
      b. Final, skim coat, on surfaces receiving a Level 5 finish.
   4. Spray-applied coating compound:
      a. Final, skim coat, on surfaces receiving a Level 5 finish.

D. Joint Compounds for Moisture Resistant Gypsum Wallboard:
   1. Setting-type joint compound:
      a. Filling open joints and voids.
      b. Embedding tape and first coat over joints, fasteners and trim flanges.
   2. Lightweight Setting-Type Joint Compound:
      a. Second and third coats.
      b. Final, skim coat on surfaces receiving a Level 5 finish.

E. Laminating Adhesive:
   1. Adhesive or joint compound recommended for directly adhering gypsum panels to continuous substrate.

2.5 ACOUSTICAL MATERIALS

A. General:
   1. Provide where indicated.
   2. Minimum nominal thickness: As required to achieve STC indicated for wall systems.
   3. Density: As required to achieve STC indicated for wall systems.

B. Sound Attenuation Batts (SAB):
   1. Glass or mineral fiber.
   2. Commercial sound blanket, ASTM C665, Type I, un-faced, produced by combining thermosetting resins with mineral fibers manufactured from glass, slag wool, or rock wool.
   3. Surface burning characteristics per ASTM E84:
      a. Maximum flame spread: 10.
      b. Maximum smoke developed: 10.
   4. Fire rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
   5. Acoustically rated assemblies: Select SAB materials and thicknesses that that are approved for use in assemblies listed.
   6. Base Product: Sound Attenuation Batt Insulation by Owens-Corning;

C. Preformed acoustical seal for wall boxes:
   1. Box Seal by STC Architectural Products
   2. Molded neoprene, durometer A-40 complying with ASTM D2000.
   3. Formed to fit the electrical device, outlet and service boxes.
   4. STC improvement: 6 db in accordance to ASTM E90.
   5. Color: Black.
   6. Provide at electrical and service box penetrations in sound-rated walls.

D. Interior joint sealants, including acoustical sealants:
   1. See Section 07 92 16.

2.6 MISCELLANEOUS ITEMS

A. Fasteners:
   1. Bugle head screws: ASTM C1002 for use with maximum 22 GA metal stud framing.
   2. Self-tapping bugle head screws: ASTM C954 for use with minimum 20 GA metal framing.
   3. Type S for gypsum wallboard to metal; Type G for gypsum wallboard to gypsum wallboard.
   4. Screws used with backer boards: As recommended by panel manufacturer.

B. Foam Tape:
   1. PVC 1/2 x 1/4 IN: With pressure sensitive adhesive; Norseal.
   2. EPDM 1/2 x 1/4 IN: With pressure sensitive adhesive; Cellular rubber by Gasket Dynamics.

C. Backing for Control Joints:
   1. Fire rated board.

2.7 OTHER MATERIALS

A. Framing and suspension systems for Gypsum Board Ceilings: Specified in Section 09 22 16.

B. Firestopping: Specified in Section 07 84 00.

C. Thermal Insulation: Specified in Section 07 21 00 and other Division 07 sections.

PART 3 - EXECUTION

3.1 INSPECTION AND PREPARATION

A. Examine supporting structure and conditions prior to wallboard installation.

B. Correct unsatisfactory conditions.

C. Start of installation constitutes acceptance of conditions and responsibility for performance.

3.2 INSTALLATION – GENERAL

A. General Requirements:
   1. Comply with ASTM C840 requirements or gypsum board manufacturer's written recommendations, whichever are more stringent.
   2. Remove loose materials and vacuum cavity of gypsum dust prior to enclosing stud space.
   3. Install wallboard vertically with edges over metal stud framing members and similar framing support members.
   4. Bring boards into contact but do not force into place.
   5. Fit neatly and carefully.
   6. Stagger edge joints on opposite side of partition so they occur on different framing members.
   7. Stagger joints in multi layer applications not less than one support from previous layer.
   8. Install with1/4 IN gap between gypsum board and floor.
   9. Seal ends, cutouts and screw penetrations of moisture resistant boards with sealer.
   10. Install wallboard over metal framing studs and similar framing support members at interior face of exterior walls full height from floor to structure above.
   11. Wallboard installation prior to building being weathertight:
      a. Replace scheduled GWB products to their mold-resistant counterparts.
         1) Products proposed are subject to Architect approval.
      b. Exposure time shall be limited by manufacturer requirements.

B. Sound Insulation:
   1. Install sound insulation in walls from floor to structure above, where sound rated walls are indicated.
   2. Install in thicknesses and densities necessary to achieve sound rating.
   3. Pack spaces around electric boxes and other penetrations to maintain full sound rating.
      a. Fill small voids that remain with Acoustical Sealant.

C. Preformed Acoustical Seal for Wall Boxes:
   1. Place preformed seal over exposed outlet box flush with wall surface with device protruding through preformed or precut opening in seal.
   2. Secure in place with outlet cover plate.

D. Wall Reveals:
   1. Install reveal wall channels and/or aluminum framing as recommended by manufacturer.

E. Screw Placement:
   1. Proceed with attachment from board center toward ends and edges.
   2. Space maximum 8 IN OC at edges and 12 IN OC in field of board.
      a. Use closer screw spacing if required by UL.
   3. Secure wallboard to vertical studs; do not secure to top track directly.
      a. Follow top track manufacturer’s screw pattern requirements.
      b. Install additional framing if required.
      c. Top track is specified in Section 09 22 16.
   4. Set screws between 3/8 IN and 1/2 IN from edges.
   5. Drive screws so head rests in slight dimple without cutting face paper or fracturing core.
   6. Duct penetrations, where lead sheet is greater than 1/8 IN thick or where duct shielding is greater than 24 IN wide:
      a. Laminate wall penetration covers to fire-retardant treated plywood or other similar structural panels conforming to shape of duct, lapping lead joints 1 IN minimum.
      b. Secure lead laminated panels to ducts with mechanical fasteners located at duct seams and corners.
      c. Where necessary to prevent lead laminated panels from overloading duct supports, independently suspend panels from hangers secured to overhead building structure.
      d. Cover fastener heads with lead sheet matching thickness of adjacent lead.
   7. Piping:
      a. Unless otherwise indicated, wrap piping with lead sheet for a distance of not less than 10 IN from point of penetration.

3.3 INSTALLING TRIM ACCESSORIES

A. For trim with back flanges intended for fasteners, attach to framing with same fasteners used for panels. Otherwise, attach trim according to manufacturer's written instructions.

B. Interior Trim:
   1. Install in following locations:
      2. Cornerbead: Use at outside corners.
      3. J-Bead or LC-Bead: Use at exposed panel edges.
      4. L-Bead: Use where wallboard abuts dissimilar surfaces and where indicated.

C. Specialty Trim:
   1. Install in locations indicated.

3.4 INSTALLATION – CEILING

A. Install in compliance with manufacturer's recommendations.

B. Stagger abutting end joints of adjacent panels’ not less than one framing member.

C. During cold or damp weather, insulate before installing gypsum board on a ceiling with a vapor barrier.

D. Access Panels and Doors: Locate where required by Section 20 05 00 and Section 26 00 10, or where indicated. See Section 08 31 16 for product description.

3.5 CONTROL JOINTS

A. General:
   1. Install Control Joints in location indicated and as described in this article.

2. Install suitable backing material to maintain required rating where Control Joints occur in fire or sound rated assemblies.

B. Partitions:
1. Provide vertical control joints on both wall faces which align with door frames, window frames, and similar opening as follows:
   a. Single Doors and Cased Opening:
      1) Locate CJ's at both jambs, from head of opening to top of partition.
   b. Pair doors:
      1) Locate CJ's at both jambs, from head of opening to top of partition.
      2) Exception: Control Joints are not required where partition forms a cross-corridor condition.
   c. Doors with adjacent sidelights:
      1) Locate CJ's at both jambs from head of opening to top of partition, and, from sill to floor at sidelight jambs.
   d. Punched windows less than 30 FT in width:
      1) Both jambs from head of opening to top of partition, and from sill edge to floor.
2. Provide additional vertical Control Joints, spaced no more than 30 FT apart from each other, from opening-related CJ's, or from corners.
3. Provide horizontal control joints at partitions which are more than one story in height:
   a. Locate horizontal Control Joints where partitions bypass each intermediate floor.
   b. Align control joint with floor line, unless otherwise indicated.

C. Ceilings:
1. Use Control Joints to subdivide ceilings/soffits as indicated, and within the following limits:
   a. Ceilings with perimeter relief:
      1) Subdivide so no area exceeds 2500 SQ FT, and no area has a length which exceeds 50 FT.
         a) Exception where ceiling occurs at exterior: Subdivide so that no area exceeds 900 SQ FT, and no area has a length which exceeds 30 FT.
   b. Ceilings without perimeter relief:
      1) Subdivide so that no area exceeds 900 square feet, and no area has a length which exceeds 30 FT.
   c. Locate control joints at transitions between areas of different shapes.

D. Soffits:
1. Use control joints to subdivide ceilings/soffits as indicated, and within the following limits:
   a. Locate Control Joints at transitions between areas of different shapes.
   b. Continue lines of soffit Control Joints vertically to top of fascia.
   c. Subdivide exterior applications so no area exceeds 900 square feet, and no area has a length which exceeds 30 FT.

3.6 WALLBOARD FINISHING

A. Treat gypsum board joints, interior angles, edge trim, control joints, penetrations, fastener heads, surface defects, and elsewhere as required to prepare gypsum board surfaces for decoration.

B. Pre-fill open joints and voids, rounded or beveled edges, and damaged surface areas.

C. Apply joint tape over gypsum board joints, except those with trim having flanges not intended for tape.

D. Where bead abuts exterior metal window frames or other metal components, separate from other material by use of foam tape.

E. Remove residual joint compound from adjacent surfaces.

F. Apply Joint Compound and Tape in accordance with fire rated design.
1. Apply joint treatment compound in accordance with manufacturer's directions.
2. Fill joints, screw heads, and internal corners with compound.

3. Extend joint system vertically from floor to extent described as follows:
    a. Fire Walls, Barriers, and Partitions: Extend to full height of wall.
    b. Smoke Barriers and Partitions: Extend to full height of wall.
    c. Interior face of exterior wall (non-rated): Extend to full height of wall.
    d. Other interior partitions (non-rated): Extend to 6 IN above ceiling.
4. Refer to Drawings for indication of partition heights.

G. Level 4 Finish:
1. After drying, sand or otherwise smooth final coat of compound as needed to eliminate high spots or excess compound to leave smooth, even, and level surface.
2. Draw down final coat of compound to a smooth even plane.
3. Locations:
    a. Wallboard scheduled to be finished with Gloss Level 1 (flat), Level 2 (velvet), or Level 3 (eggshell) paint, glazed coating, textured coating, or wall covering.
    b. Where above listed surfaces are to be finished with textured decorative treatments, wall covering, paneling, or wall guard.
    c. All remaining locations, unless noted otherwise.

H. Level 5 Finish:
1. Trowel skim coat of joint compound leaving a thin film covering the entire surface, in accordance with manufacturer’s recommendations.
2. Make surfaces free of tool marks and ridges.
3. Locations:
    a. Exposed ceiling, soffit, or wall areas abutting window mullions, skylights, or receiving direct indoor lighting.
    b. Hallways or corridors unbroken by doorways or windows in excess of twenty feet.
    c. Atriums, Lobbies, Auditoriums and similar large spaces.
    d. Multi-story spaces.
    e. Wall board scheduled to be finished with Gloss Level 4 (satin), Level 5 (semi-gloss), Level 6 (gloss), Level 7 (high gloss), paint, glazed coating, textured coating, or wall covering.
    f. Surfaces using MRB or other wallboard types with a glass mat facer on finished side.

I. Cementitious Backer Units:
1. Finish according to manufacturer's written instructions.

J. Repairs:
1. After painter has applied primer to wallboard surfaces, repair and refinish defective areas.
2. If wallboard is damaged, or surfaces are roughened, repair or replace.

3.7 PARTITION IDENTIFICATION

A. Identify partitions indicated on Drawings as having a required fire or smoke rating.
1. Follow guidelines set in Chapter 7 of International Building Code or as locally amended.
2. Permanently identify with signs or stenciling with contrasting background.
    a. Minimum 3 IN high letters with minimum 3/8 IN stroke.
    b. Provide in manner acceptable to authority having jurisdiction.

3.8 FIRE AND SMOKE WALL IDENTIFICATION

A. Identify walls indicated on Drawings as having a required fire or smoke rating.
1. Follow guidelines set in Chapter 7 of International Building Code.
2. Permanently identify rating and type of barrier with stencil and paint in contrasting, 3 IN high letters in a manner acceptable to authority having jurisdiction.
3. Text for fire and smoke barriers: “X HOUR FIRE AND/OR SMOKE BARRIER – PROTECT ALL OPENINGS.”

3.9 PROTECTION

A. Protect installed wallboard from water damage during construction.

B. Protect installed products from damage from weather, condensation, direct sunlight, construction, and other causes during remainder of the construction period.

C. Remove and replace panels that are wet, moisture damaged, and mold damaged.
   1. Indications that panels are wet or moisture damaged include, but are not limited to, discoloration, sagging, or irregular shape.
   2. Indications that panels are mold damaged include, but are not limited to, fuzzy or splotchy surface contamination and discoloration.

D. Prior to finishing, walls shall be inspected for visible mold growth.
   1. Replace affected portions.

END OF SECTION

SECTION 09 30 00
TILE

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Tile, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Minimum ten (10) years experience in manufacture of tile, setting and grout materials.

B. Installer Qualifications:
   1. Specializing in tile work having minimum of five (5) years successful documented experience with work comparable to that required for this Project.

C. Single Source Responsibility:
   1. Obtain each type and color tile material required from single source.
   2. Provide compatible materials for tile system.

D. Certifications:
   1. Submit Master Grade Certificate for each type of ceramic, quarry, and paver tile in accordance with requirements of ANSI A137.1.
   2. Submit manufacturer's certifications that mortars, adhesives, and grouts are suitable for intended use.

E. TCNA Handbook for Ceramic, Glass and Stone Tile Installation by Tile Council of North America, latest edition.

F. Ceramic Tile Institute of America (CTIOA).

G. ASTM International (ASTM):
   1. ASTM C373 Water Absorption, Bulk Density, Apparent Porosity, and Apparent Specific Gravity of Fired Whiteware Products.
   2. ASTM C623 Young’s Modulus, Shear Modulus, and Poisson’s Ratio for Glass and Glass-Ceramics by Resonance.
   3. ASTM C627 Robinson Floor Test for Tile Service Level.
   4. ASTM D4068 Standard Specification for Chlorinated Polyethylene (CPE) Sheeting for Concealed Water-Containment Membrane.
   5. ASTM D4551 Standard Specification for Poly (Vinyl Chloride) (PVC) Plastic Flexible Concealed Water-Containment Membrane.
   6. ASTM E90 and ASTM E413 for STC (Sound Transmission Class).
   7. ASTM E492 and ASTM E989 for IIC (Impact Insulation Class) – Sound Deadening Underlayments.

H. American National Standards Institute (ANSI):
   1. ANSI A108.5 Installation of Ceramic tile with Dry-Set Portland Cement or Latex-Portland Cement.
   2. ANSI A108.10 Installation of Grout in Tilework.
   3. ANSI A108.13 Installation of Membranes for Thin-Set Ceramic Tile.
   4. ANSI A108.17 Installation of Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone.
   5. ANSI A118.1 Standard Dry-Set Cement Mortars.

6. ANSI A118.3 Chemical Resistant, Water-Cleanable, Tile-Setting and-Grouting Epoxy and Water-Cleanable Tile-Setting Epoxy Adhesive.
7. ANSI A118.4 Modified Dry-Set Cement Mortar.
8. ANSI A118.7 High Performance Cement Grouts.
9. ANSI A118.10 Load-Bearing, Bonded Waterproofing Membranes for Thin-Set Ceramic Tile and Dimension Stone Installation.
10. ANSI A118.12 Crack Isolation Membranes for Thin-set Ceramic Tile and Dimension Stone Installation.
11. ANSI A118.15 Improved Modified Dry-Set Cement Mortars.
12. ANSI A136.1 Organic Adhesives for Installation of Ceramic Tile.
13. ANSI A137.1 Ceramic Tile.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Indicate tile layout, patterns, color arrangement, perimeter conditions, junctions with dissimilar materials, movement joints, thresholds, ceramic accessories, and setting methods and details.

B. Samples:
   1. Three full size samples of each tile specified in Drawing I-001 Interior Notes and Finish Legend.
   2. Grout: Submit manufacturer's full range of standard and designated color samples for each type for Architect's selection.
   3. Grout: Submit samples mounted in 6 IN long metal channels for each type and color specified.

C. Project Information:
   1. Installation methods.
   2. Manufacturer's Certificate: For each shipment, type and composition of tile provide a Master Grade Certificate signed by manufacturer and installer certifying products meet or exceed specified requirements of ANSI A137.1-2012.

D. Contract Closeout Information:
   1. Maintenance Data:
      a. Include recommended cleaning methods, cleaning materials, stain removal methods, and polishes and waxes.
      b. See Section 01 78 23.

1.4 EXTRA MATERIAL

A. Provide 10% of total SQ FT of each type, color or size specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Ceramic Tile:
   1. Base:
      a. As indicated on Sheet I-001, Interior Notes and Finish Legend.

B. Accessories:
   1. Base:
      a. Schluter Systems LP.
   2. Option:
      a. Custom Building Products.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Ceramic Tile:
   1. Comply with ANSI A137.1 American National Standard Specifications for Ceramic Tile for types, compositions, and grades of tile indicated.
   2. Furnish tile complying with Standard Grade requirements unless otherwise indicated.
   3. ANSI Standard for Tile Installation Materials: Comply with ANSI standard referenced with products and materials indicated for setting and grouting.

B. Colors, Textures, and Patterns:
   1. Where manufacturer's standard products are indicated for tile, grout, and other products requiring selection of colors, surface textures, patterns, and other appearance characteristics, provide specific products or materials complying with the following requirements:
      a. Match Architect's sample.
      b. Provide tile trim and accessories that match color and finish of adjoining flat tile unless noted otherwise.

C. Factory Blending:
   1. Blend tile in factory and package accordingly so tile are uniform in color range as those throughout packaging and match approved samples.

D. Factory Mounting:
   1. Provide back-face or edge-mounted tile assemblies as standard with manufacturer unless another mounting method is indicated.
   2. Do not use back- or edge-mounted tile assemblies for swimming pools, exterior applications or wet areas.

2.3 CERAMIC TILE

A. Ceramic Wall Tile
   1. Grade: ANSI A137.1; 5.0 to 10.0 percent water absorption.
   2. Color/Size: As indicated on Sheet I-001, Interior Notes and Finish Legend.

B. Ceramic Floor Tile
   1. Grade: ANSI/A137.1; 0.5 to 3.0 percent water absorption.
   2. Color/Size: As indicated on Sheet I-001, Interior Notes and Finish Legend.

2.4 TRIM

A. All exposed edges to be Schluter trim, typical.

2.5 MORTAR, GROUT, AND ADHESIVE MANUFACTURERS

A. Setting materials: As required by installation Method, See Part 3.

2.6 MORTAR MATERIALS - THICK SET BEDS

A. Portland Cement With Latex Additive; Thick-Set:
   1. Portland Cement: ASTM C150, Type I, from one source only, non-staining and non-air-entraining.
   2. Supplemental cementitious materials derived from coal fired power plant wastes shall not have a mercury content >5.5ppb.
   3. Fly ash shall not be a byproduct of municipal solid waste incinerators
   4. Mortar Sand: ASTM C144, free of deleterious materials, well graded.
   5. Setting Bed Sand: ASTM C136, 100 percent passing No. 4 sieve.
   6. Latex Additive:
      a. Description: Latex additive serving as replacement for gaging water, for use with site mixed portland cement mortar.
      b. Quantity: As recommended by latex additive manufacturer to produce workable consistency.

c. Acceptable Products:
   1) CustomFloat Bedding Mortar mixed with Acrylic Mortar Admix 1:1 water by Custom Building Products.
   2) 3701 Mortar Admix by Laticrete.
   3) Planicrete 50 by Mapei.

2.7 MORTAR MATERIALS - THIN SET BEDS

A. Portland Cement with Latex Additive; Thin-Set:
   1. Description: Latex additive and site mixed Cement mortar. Complying with ANSI-A118.4.
   2. Quantity: As recommended by latex additive manufacturer.
   3. Acceptable Products:
      a. CustomCrete Latex Mortar Admix with site mixed Mortar or CreteMix Mortar by Custom Building Products.
      b. 4237 Latex Thin set Mortar Additive by Laticrete.
      c. Keracrete System consisting of KER 303 Latex mixed with 1:1 sand/cement blend by Mapei.

2.8 GROUT

A. Unsanded Urethane Grout:
   1. Description: Pre-mixed non-cementitious urethane , factory blended, antimicrobial, mildew resistant, non-sanded, grout; complying with ANSI A118.3-UG..
   2. Color: To be selected.
   3. Acceptable Products:
      a. QuartzLock2 by Bostik.

2.9 ACCESSORIES

A. Joint Sealant:
   1. Two component polyurethane sealant, ASTM C920, Type M, self-leveling, for horizontal joints, Type II, non-sag, for vertical joints as specified in Section 07 92 16.
   2. Color: Match grout.
   3. Sealant:
      a. Chemically compatible with tile, mortar, and grout.
      b. Physically and chemically capable to withstand local environmental conditions.

B. Joint Backing: Closed cell foam polyethylene.

C. Prefabricated Sealant Joint:
   1. Prefabricated aluminum joint with two part, chemically curing non-sag polyurethane sealant.
   2. Size: Height as required by tile by 8 FT lengths.
   3. Color:
      a. Aluminum: Clear anodized.
      b. Sealant: Match grout.
   4. Acceptable Products:
      a. Interior, Non-Traffic Areas: PolyBlend Ceramic Tile Caulk by Custom Building Products.

D. Expansion and Control Joints for Thin-set and/or Thick-set Applications:
   1. Main Material:
      a. Extruded aluminum
   2. Profiles joined by a soft CPE movement joint material, with integral perforated anchoring legs for setting the joint into the setting bed.
   3. Height: As required to suit application.
   4. Color: As selected by Architect.
   5. Acceptable Products:
      a. Schlüter - DILEX-KS

E. Corner Joints:
   1. Extruded rigid coved wall corner, with integral perforated anchoring legs.
   2. Floor Leg Height: As required to suit application.
   3. Wall Leg Height: As required to suit application.
   4. Material: Aluminum.
   5. Acceptable Products:
      a. Schlüter - DILEX-HK

F. Corner Movement Joints:
   1. Roll-formed stainless steel inside corner, cove-shaped 2-piece joint profile joined by soft thermoplastic rubber movement zone and with perforated anchoring.
   2. Floor Leg Height: As required to suit application.
   3. Wall Leg Height: As required to suit application.
   4. Material: Aluminum.
   5. Acceptable Products:
      a. Schlüter - DILEX-HKW

G. Transition Joint Strips:
   1. Solid brass or extruded aluminum transition strips; profile and height as indicated; with integral perforated anchoring leg for setting strip into setting material.
   2. Transition strip profile:
      a. Sloped, variable height: where adjacent flooring level is different than tile.
         1) Schluter-RENO-V.
      b. Flat, smooth profile: where adjacent flooring level is same as tile. Patient room toilet doorways.
         1) Schluter- 5/16 IN AE-80
            a) Use Johnsonite Subfloor Leveler System as well. Transition heights may vary so may use any of the following:
               (1) LS-40-D 3/8 inch to nothing
               (2) LS-40-E 1/2 inch to nothing
               (3) LS-40-G 3/4 inch to nothing
            b) All sides of the transition strip need to be feathered out to 2 IN.
      c. Sloped, narrow profile: where adjacent flooring level is lower than tile.
         1) Schlüter - RENO-U.
   3. Height:
      a. As required to suit application.
      b. Maximum change in level: 0-1/2 IN.
      c. Maximum slope: 1:2.
   4. Material: Aluminum.

H. Decorative Wall Corner Trim:
   1. Aluminum, solid brass, or stainless steel, wide profile, decorative outside wall corner trim, with integral perforated anchoring leg.
   2. Height: As required to suit application.
   3. Material:
      a. Aluminum.
   4. Acceptable Products:
         1) Schlüter – RONDEC

I. Edge and Transition Strips:
   1. Extruded aluminum edge strips, 1/8 IN wide at top edge; height as indicated.
   2. Height: As required to suit application.
   3. Finish:
      a. Clear-satin anodized aluminum.
   4. Acceptable Products:
         1) Schlüter - SCHIENE M

J. Setting Buttons:
   1. Plastic buttons of thickness required for joint size indicated to maintain uniform joint width.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Comply with requirements of referenced standards and recommendations of material manufacturers for environmental conditions before, during, and after installation.

B. Verify concrete floor surfaces are suitable for tile installation.
   1. Firm, dry, clean and free of oily or waxy films, mortar and soil.
   2. Grounds, anchors, plugs, hangers, bucks, electrical and mechanical work in or behind tile installed.
   3. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.
   4. Verify limits of moisture and alkalinity are within levels tolerated by Tile manufacturer and setting materials manufacturer.
   5. Verify areas to receive tile installed by thin bed method have wood float finish, are true within 1/4 IN in 10 FT and are pitched to drains where required.

C. Correct unsatisfactory conditions and proceed with installation only after substrate deficiencies have been corrected and surfaces are acceptable.

D. Start of work constitutes acceptance of surfaces, and waiver of claim that surfaces are unsuitable.

3.2 PREPARATION

A. Prepare surfaces in accordance with manufacturers' instructions for setting materials or additives used.

B. Acid based cleaners are not permitted.

C. Completely remove curing compounds or other substances that would interfere with proper bond of setting materials.

D. Do not seal substrate unless required by manufacturer.

E. Prime substrate when required by manufacturer.

F. Factory Blending:
   1. Blend tile in factory and package accordingly so tile are uniform in color range as those throughout packaging and match approved samples.
   2. If not factory blended, either return to manufacturer or blend tiles at Project site before installing.

3.3 INSTALLATION

A. Tile Backer Board:
   1. Place and fasten with galvanized or resin coated gypsum board screws at 8 inches on center in field of panel and at 6 inches on center at edges.
   2. Provide 1/4 inch gap above floor or fixture lip for flexible calking.
   3. Maintain manufacturer's required space between board edges.
   4. Fill joints by applying tile setting material and joint reinforcement.

B. Membrane:
   1. Install membrane with products or methods approved in writing by membrane manufacturer.
   2. Flash membrane to cure prior to setting tile.
   3. Do not allow construction traffic on membrane.

C. Waterproofing:
   1. Install waterproofing in accordance with manufacturer's instructions.
   2. Return waterproofing vertically at adjacent walls in accordance to manufacturer's details, to minimum height of 4 IN.
   3. Flood test waterproof membranes after fully cured.
   4. Field Quality Control water test when required.

D. Tile Installation, General:
   1. Install tile materials in accordance with ANSI A137.1-2012, other referenced ANSI and TCNA specifications, and TCNA Handbook for Ceramic Tile Installation, with exception of more stringent requirements of manufacturer or these Specifications.
   2. Cut and fit tile tight to protrusions and vertical interruptions and treat with sealant. See Section 07 92 13 and Section 07 92 16.
   3. Form corners and bases neatly.
   4. Install ceramic cove base in accordance with TCNA Flush style. Thin-lip installation is not allowed.
   5. Work tile joints uniform in width, subject to variance in tolerance allowed in tile size.
   6. Make joint watertight, without voids, cracks, excess mortar, or grout.
   7. Prepare surface, fit, set, bond, grout and clean in accordance with applicable requirements of ANSI standards and Tile Council of North America.

E. Layout:
   1. Lay out work to pattern indicated so that full tile or joint is centered on each wall and no tile of less than half width need be used.
   2. Do not interrupt pattern through openings.
   3. Lay out tile to minimize cutting and to avoid tile less than half size.
   4. For heights stated in feet and inches, use courses of full tile to produce nearest attainable heights without cutting tile.
   5. Do not stagger joints.
   6. Align joints in tile in both directions.
   7. Align joints between floor and base tile.
   8. Make joints between sheets of tile exactly same width as joints within sheet.
   9. File edges of cut tile smooth and even.
   10. Cut and fit tile at penetrations through tile.
   11. Grind edges of tile abutting built-in items.
   12. Fit tile at outlets, piping and other penetrations so that plates, collars, or covers overlap tile.
   13. Extend tile work into recesses and under or behind equipment and fixtures, to form complete covering without interruption, except as otherwise indicated.
   14. Accurately form intersections and returns.
   15. Form internal corners and external corners square.

F. Thin Set Method, Floors and Walls:
   1. Apply mortar or adhesive with notched trowel using scraping motion to work material into contact with surface to be covered.
      a. Maintain 90 percent coverage on back of tile and fully bed corners.
   2. Apply only as much mortar or adhesive as can be covered within time recommended by mortar or adhesive manufacturer.
   3. When installing large tiles, ceramics or mosaics, trowel small quantity of mortar or adhesive onto back of each tile or sheet of tiles.
   4. Set tiles in place and level surface of tile.
   5. Align tile to show uniform joints and set until firm.
   6. Clean excess mortar or adhesive from surface of tile while mortar is fresh.
   7. Sound tile after setting. Replace hollow sounding tiles.

G. Grouting:
   1. Allow tiles to set before grouting.
   2. Install in accordance with grout manufacturer's recommendations and ANSI A108.10.

3. Clean excess grout from surface as work progresses.
4. Cure after grouting by covering with kraft or construction paper for 72 hours.
5. Install sealant in vertical wall joints at interior corners.

H. Movement Joints:
1. Comply with TCNA EJ171.
2. Coordinate with Drawings.
3. Locate movement joints where indicated.
4. Where not indicated, locate movement joints directly over following substrate conditions:
   a. Changes in substrate material.
   b. Over control joints, expansion joints and seismic joints in substrate.
   c. Over construction joints in substrate.
   d. At junctures where floors meet walls and other restraining elements such as curbs, columns, bases, and wall corners.
   e. At other locations recommended by TCNA EJ171 Movement Joint requirements.
5. Locate additional movement joints per following:
   a. Exterior: 12 FT.
   b. Interior: 25 FT.
   c. Interior, where exposed to direct Sunlight or moisture: 12 FT.
6. Joint Width: In accordance with TCNA EJ171.
7. Rake or cut control joints through setting bed to supporting slab or structure.
8. Maintain joints free of mortar.
9. Fill joints with self-leveling polyurethane sealant and backing material specified in Section 07 92 13 and Section 07 92 16.
10. Provide sealant material at items penetrating tile work, unless otherwise indicated.
11. Apply sealant to junction of tile and dissimilar materials and junction of dissimilar planes.
12. Fill joints around water closets with white silicone sealant. Refer to Section 07 92 13 and Section 07 92 16.
13. Use manufacturer's expansion joint flashing when covering expansion joints with waterproof or crack isolation membranes.

3.4 CLEANING

A. Perform cleaning while mortar is fresh and before it hardens on surfaces.

B. Wash tile diagonally across joints.

C. Polish with clean dry cloth.

D. Remove grout haze following recommendation of mortar additive manufacturer.

E. Remove residual waxes or grout release agent, temporary protective coatings, by method recommended by coating manufacturer.
1. Confirm acceptability with brick and grout manufacturer.
2. Trap and remove coating to prevent it from clogging floor drains.

3.5 PROTECTION

A. Prohibit traffic on floor finish for 72 hours after installation.

B. Where temporary use of new floors is unavoidable, supply large, flat boards or plywood panels for walkways over kraft paper.

C. Broken, cracked, chipped, stained, or damaged tile will be rejected.

3.6 INSTALLATION METHODS

END OF SECTION

SECTION 09 51 00

ACOUSTICAL & CEILING TILE MATERIALS (AM)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Acoustical and Ceiling Tile Materials (AM) in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM C635 Standard Specification for Metal Suspension Systems.
   2. ASTM C636 Standard Specification for Installation of Metal Ceiling Suspension Systems.
   3. ASTM E580 Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions

B. Site Classification and Seismic Design Categories as defined in the International Building Code.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s product data that products comply with acoustical properties indicated on Drawing I-001 Interior Notes & Finish Legend.

B. Samples:
   1. Three samples of each type of tile listed in Drawing I-001 Interior Notes and Finish Legend.

C. Contract Closeout Information:
   1. Maintenance data.
      a. See Section 01 78 23.
   2. Interior finish fire performance data:
      a. Provide for each finish material and type specified:
         1) Manufacturer's printed information including:
            a) Fire class.
            b) NFPA test number.
            c) Photograph.
         2) Proof of purchase.
         3) See Section 01 78 26.

1.4 EXTRA MATERIAL

A. Provide 2 full boxes of each type, color or size specified.

B. See Section 01 78 43.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Steel Suspension Systems:
   1. Base:
      a. USG.

B. Ceiling Tile - Wet formed mineral fiber:
   1. Base:
      a. As noted for individual types in Drawing I-001 Interior Notes & Finish Legend.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS - ACOUSTICAL SUSPENSION SYSTEMS

A. Suspension Systems:
   1. Heavy duty systems, ASTM C635.
   2. Main runner jointing by spliced, interlocking ends, tab locks, pin locks, or other suitable connections.
   3. Cross runners interlocking with main runners.

B. Hanger Wire:
   1. General:
      a. Pre-stretched, with a yield stress load of at least 5 times design load, but not less than 0.106 IN (12 GA).
      b. Utilize continuous lengths, without kinks and splices.
   2. Galvanized Steel:
      a. Galvanized, soft annealed steel wire conforming to ASTM A641.

C. Provide moldings wherever ceiling meets walls, partitions, other vertical elements, and other types of ceilings or ceiling fixtures. No additional trim is required at ceiling mounted fixtures with integral flange trim.

D. Attachment Devices:
   1. Anchors in Concrete:
      a. Anchors of type and material indicated below, with holes or loops for attaching hangers of type indicated and with capability to sustain, without failure, a load equal to 5 times that imposed by ceiling construction, as determined by testing per ASTM E488 or ASTM E1512.
      b. Acceptable types: Cast-in-place, post-installed expansion anchors and post-installed bonded anchors.

E. Suspension systems - types:
   1. CG-1: Exposed grid, non-rated:
      a. Description: Galvanized, double web steel, main and cross runners.
      b. Face width: 15/16 IN.
      c. Base Product:
         1) Donn DX/DXL by USG.
      d. Finish on exposed surfaces: Smooth, flat white.

F. Framing and suspension systems for Gypsum Board Ceilings:
   1. Specified in Section 09 22 16.

2.3 MATERIALS - CEILING TILES

A. General:
   1. Scheduled finishes to be factory applied.
   2. Class A incombustible units.
   3. Fire rated units (when used): UL labeled.
   4. Edges uniformly fabricated, true, square.
   5. Sizes as required to fit scheduled suspension system.
   6. Standard tile size: See Reflected Ceiling Plan.
   7. Concealed spline style: Edges kerfed for splines.

B. Ceiling Tile – Wet Formed Mineral Fiber:
   1. See schedule for pattern and surface texture.
   2. Light reflectance: Not less than 0.75.
   3. Noise reduction coefficient: 0.50 – 0.65.
   4. Lay-in style: Minimum 5/8 IN thick.

C. Light Fixtures: Specified in Section 26 51 13.

2.4 FABRICATION

A. Intersections between Main Tees and Cross Tees: Butt cut and notch as required.

B. Perimeter Wall Angles: Fabricate to match the system specified.

C. Include components and accessories necessary resist seismic loads and dead loads of items such as light fixtures and air diffusers.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Examine installation site for unevenness or irregularities that would affect quality and execution of work.

C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

A. Consult other trades involved before start of ceiling work, to determine areas of potential interference.

B. Coordinate ceiling layout with work penetrating acoustical ceiling systems.

C. Coordinate with sprinkler head spacing.

D. Do not start installation until interferences have been resolved.

3.3 INSTALLATION TOLERANCES

A. Comply with ASTM C635: Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings.

B. Maximum deviation from level plane: Not to exceed 1/8 IN in 10 FT with no load applied.

C. Maximum Bow: Not to exceed 1/32 IN in 2 FT.

D. Maximum Camber: Not to exceed 1/32 IN in 2 FT.

E. Maximum Twist: Not to exceed 1 Degree in 2 FT.

3.4 INSTALLATION - SUSPENSION SYSTEM - GENERAL

A. Install suspension system in accordance with manufacturers' instructions.

B. Grid layout: See Reflected Ceiling Plans.
   1. Install grid square with room and with grid center lines or acoustical panel center lines coinciding with center lines of room, each direction.
      a. Acoustical panel dimension at perimeter walls: Not less than 6 IN.
      b. In case of conflict with lighting plan, contact Architect.

C. Do not use defective or damaged materials.

D. Leave suspension system ready to accept installation of acoustic materials.

3.5 INSTALLATION – WALL ANGLES

A. Install wall angles where ceilings meet walls, partitions, other vertical elements, and other types of ceilings.
   1. Secure wall angles to wall construction at stud locations.
      a. Maximum spacing from terminal ends: 3 IN.
      b. Draw fasteners tight against vertical surfaces.
   2. Level tolerance: not more than 1 in 1000.
   3. Miter cut inside and outside corners.

4. Install with leg supporting bottom flange of runners.

3.6 INSTALLATION – HANGER WIRES

A. Provide hangers and inserts necessary to support ceiling suspension systems and ceiling dead loads.

B. Coordinate location and alignment with work of other trades.

C. Install hanger wires plumb to main tees and cross tees.
   1. Do not suspend any part of suspension system from ducts, pipes, conduit, equipment, cable tray, etc.
   2. Provide supplementary rough suspension system where necessary to support ceilings beneath pipes, ducts, equipment, etc.
   3. Splay hangers no greater than 30 degrees from vertical to avoid obstructions or other conditions that prevent plumb, vertical installation.
   4. Offset horizontal forces by bracing or countersplaying.

D. Space hangers to prevent eccentric deflection and rotation due to loads from items in or on ceiling
   1. Provide additional hangers to support lighting fixtures.
   2. Provide additional hangers within 6 IN of end of main runners.
   3. Do not bear runners on walls or partitions.

3.7 INSTALLATION – MAIN RUNNERS

A. Utilize wall angles to align and receive terminal ends of main tees without transferring load to Wall Angle.

B. Space main tees as indicated, and as required to receive lay-in panels and fixtures.

C. Support terminal ends of main tees by wires located within 6 IN from boundary walls.

D. Suspend main tees from building superstructure with hanger wires specified.

3.8 INSTALLATION – CROSS RUNNERS

A. Space cross tees as indicated, and as required to receive lay-in panels and fixtures.
   1. Install cross runners with a positive interlock.

B. Utilize wall angles to align and receive terminal ends of Cross Tees without transferring load to Wall Angle.

C. Support terminal ends of cross tees by wires located within 6 IN from boundary walls.

D. Suspend main tees from building superstructure with hanger wires specified.

3.9 INSTALLATION – LAY-IN ITEMS

A. Install acoustic materials into suspension system in accordance with manufacturer's instructions.

B. Install lay-in panels, fixtures, diffusers, grilles, and similar items in a manner that will not compromise performance of the suspension system.
   1. Provide supplemental hangers for fixtures which exceed manufacturer’s published load data.
      a. Supplemental hanger systems shall be approved by Building Official.

C. Field cut as required to fit materials to grid.
   1. Tegular and similar tiles articulated edges:
      a. Field-cut edges to match profile of factory edges and paint to match.
   2. Ceiling Touch-Up Paint: Armstrong SuperCoat Ceiling Panel Touch-up Paint.
      a. Use to hide minor surface scratches and nicks and cover field cut edges exposed to view.

D. Make cuts square and true.

E. Do not install damaged units.

3.10 CLEANING

A. Perform cleaning and replacement of defective units in time to avoid delay in progress of work and before final completion of work.

B. Carefully clean soiled surfaces.

C. Remove and replace irregular, discolored, defective or damaged components at no additional expense to Owner.

3.11 PROTECTION

A. Protect installed materials from damage.

END OF SECTION

SECTION 09 57 53
METAL SECURITY CEILING

PART 1 - GENERAL

1.1 SUMMARY

A. Extent of metal security ceiling is indicated on the drawings, including basic layout and type of units required.

B. Metal security ceiling includes but is not limited to the following:
   1. Metal security ceiling panels.
   2. Suspension system as required.
   3. Steel trim, bearing angles and plates.
   4. Touch-up field painting.

1.2 RELATED WORK

A. Work related to this section is specified in the sections listed below:
   1. Section 04 81 0 –Unit Masonry
   2. Section 08 31 1 – Access Doors and Frames
   3. Section 07 92 0 – Joint Sealants
   4. Section 09 91 2 – Painting and Finishing
   5. Division 15 – Mechanical
   6. Division 16 - Electrical

1.3 SUBMITTALS

A. Shop Drawings:
   1. Submit shop drawings prepared by installing contractor in accordance with General Conditions and Division 1.
   2. Use of sepia transparencies of Contract Drawings for shop drawings will not be acceptable.
   3. Show all reflected ceiling layouts for areas to receive metal panels, edge details, joint details, anchorage details, tamper resistant fastening systems, finish, opening treatment, connection to adjacent work, and other pertinent data.
   4. Show details of connections to Work of other trades where applicable.
   5. Submit typical layout showing size and spacing of suspension system and fasteners as related to structural framing.

B. Manufacturer's Product Detail
   1. Product Data: Submit manufacturer's specifications and installation instructions for each type of metal security ceiling decking and accessories. Include manufacturer's certification as may be required to show compliance with these specifications.
   2. Submit acoustic laboratory test reports for sound absorption (NRC) and sound transmission loss (STC). The actual product to be installed must be tested.
   3. Submit manufacturer's printed technical and performance data.
   4. Submit manufacturer's printed installation instructions for metal panels and fasteners.

C. Replacement Materials
   1. Provide maintenance stock of 2% of the total area installed, to be turned over to the Owner at Substantial Completion. This stock must be delivered from the same manufactured lot as the materials installed, properly secured and identified.

1.4 QUALITY ASSURANCE

A. Codes and Standards: Meet or exceed with provisions of the following codes and standards, except as otherwise indicated or specified:
   1. AISI "Specification for the Design of Cold-Formed Steel Structural Members".
   2. AWS D1.1 "Structural Welding Code".

a. SDI “Design Manual for Composite Decks, Form Decks and Roof Decks”.

B. Qualifications of Field Welding: Qualify welding processes and welding operators in accordance with AWS “Standard Qualification Procedure”.

C. Welded decking in place is subject to inspection and testing. Expense of removing and replacing portions of decking form testing purposes will be borne by Owner if welds are found to be satisfactory. Remove work found to be defective and replace with new acceptable work.

D. Performance Requirement: Install and anchor deck units to resist two point loads of upward and downward force of 1200 pounds at any exposed portion of the ceiling in a 12” by 12” area by a maximum deflection of .250 inch in either direction. The Owner and the Architect shall make the final determination as to meeting the performance requirement. Use structural steel framing members tied to the units and structural members above as required to meet the performance requirement. Do not expose fasteners below the deck and maintain clearances for maintenance work on mechanical and electrical items within the interstitial space Provide this framing support and detail connections on the shop drawing submittal.

E. Field measurements and the coordination of requirements of other trades, such as mechanical and electrical, are the responsibilities of the Contractor.

F. Requirements of Regulatory Agencies:
1. Fire hazard performance with ASTM E 84 Tunnel Test Method and Federal Specifications SS-Sl 18a.
2. Noise reduction coefficient (NRC) in accordance with ASTM C 423, (See also 2.3-C this specification).
3. Sound transmission class (STC) in accord with AIMA 1-11, “Ceiling Sound Transmission Test by Two-Room Method”.

G. Qualifications of Installers: Minimum of three (3) project installations of comparable extent as this Project. Show proof that Installer has been in business continuously for a period of at least (3) years.

H. Qualifications of Panel Manufacturer:
1. Ceiling panel manufacturer must provide the following data:
   a. Years of experience in manufacturing correctional security metal panel acoustic systems and related acoustical components.
   b. Acoustical performance testing and other capabilities related to the development, production, and testing of acoustical products.
   c. Identify any work relating to the manufacturer of modular panels that may be “contracted out” by Manufacturer. Provide names, addresses and phone numbers of contracted firms.
   d. List of minimum three projects and references for similar projects and specific room applications using proposed metal acoustical products.
   e. Performance bonding for this Project.

I. Provide Noise Reduction Coefficient of 0.90 minimum.

1.5 ENVIRONMENTAL CONDITIONS

A. Building Conditions: Install materials only when normal temperature and humidity conditions approximate interior conditions that will exist when building is occupied. Wet work shall have been completed, and shall be dry. Glazing shall be in place. General Contractor shall provide heat and ventilation as necessary to maintain proper conditions before, during and after ceiling work is performed.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTUERS

A. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Epic Metals Corporation
   2. Bowman Company
   3. Vulcraft Company
   4. Trussbilt, inc.

2.2 MATERIALS

A. Steel for Metal Security Ceiling Units: ASTM A446, Grade A.

B. Miscellaneous Steel Shapes: ASTM A36

C. Sheet Metal Accessories: ASTM A526

D. Galvanizing Repair Paint: High zinc-dust content paint for repair of damaged galvanized surfaces complying with Military Specifications MIL-P-21035 (Ships).

2.3 FABRICATION

A. General: Form deck units in lengths to span two or more supports, with ends over bearing members and interlocking or nested side laps, unless otherwise indicated.

B. Metal Security Ceiling Panels: Fabricate flat-bottom units with top fluted section cells combined on a lower flat plate. Units shall be 3” cellular deck 16/16 gauge with perforated embossed acoustical bottom in 24” width, and shop primed.

C. Sound absorbing elements shall consist of an inert non-organic mineral fiber material formed into pads and placed in the void spaces between the vertical perforated webs or cells. Provide a means of support that will prevent the pads from resting directly on the lower membrane of the deck units.

D. Coordinate and perform cutouts required for mechanical or electrical systems, and provide reinforcing steel frames at openings as necessary to maintain membrane strength. Openings of 8” x 8” or less shall be done by the trade requiring them and will not require reinforcing.

E. Supports, Trim and Accessories: Provide standard bent or otherwise custom fabricated bolts, nuts, plates, anchors, 3/8” A307 threaded rod hangers, dowels and other miscellaneous steel and iron anchoring for securing deck to masonry or other structures. Fabricate items to sizes, shapes and dimensions required. The Work of this Section shall include secondary framing system, to resist specified uplift requirements.

F. Grout: Comply with ASTIVI C476, for fine grout. Provide fiberglass fabric stops on existing reinforcing of base of grout.

G. General: Provide materials selected for their surface flatness, smoothness and freedom from surface blemishes where exposed to view in the finished unit. Do not use materials having exposed-to-view surfaces exhibiting pitting, seam marks, and roller marks.

H. Fasteners: Use fasteners made of the same basic metal as the fastened metal, unless otherwise indicated. Do not use metals that are corrosive to or incompatible with materials joined. Do not use exposed fasteners except where unavoidable; use security screws. Match finish of metal surrounding fastener, unless otherwise indicated. Acceptable security fasteners are “Torx” head, torque-off head, or pinned Allen head type.

I. Anchors and Inserts: Use nonferrous metal or hot-dip galvanized anchors and inserts for exterior installations and elsewhere as required for corrosion resistance. Use toothed steel or lead expansion bolt devices for drilled-in-place anchors. Furnish inserts, as required, to be set into concrete or masonry work.

J. Provide straps, plates and brackets as required for support and anchorage of fabricated items to adjoining work.

K. Shop Primer for Supports, Fasteners, and Anchors: Provide manufacturer's or fabricators standard, fast-curing, lead-free, "universal" primer, selected for resistance to normal atmospheric corrosion, for compatibility with finish paint system indicated and for capability to provide a sound foundation for field-applied topcoats despite prolonged exposure. Comply with the performance requirements of Federal Specification TT-P-645.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine the areas and conditions under which ceiling units are to be installed. Notify the Architect/Engineer in writing of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected.

3.2 INSTALLATION

A. General: Install units and accessories in accordance with manufacturer's recommendations and final shop drawings, and as specified herein.

B. Placement of Ceiling Units: Place units on supports and adjust to final position with ends accurately aligned and bearing on supporting members before being permanently fastened. Do not stretch or compress side lap interlocks.

C. Place units in straight alignment for entire length of run with close alignment between cells at ends of abutting units.

D. Place units flat and square, secured to adjacent framing without warp or deflection.

E. Units shall not be used for storage or working platforms until permanently secured.

F. Cutting and Fitting: Cut and neatly fit deck units and accessories around other work projecting through or adjacent to the decking, as shown on the drawings. This work shall include but not be limited to openings for sprinkler equipment, lighting fixtures and conduit, speaker housings, HVAC grilles, and conduit stubs as required above intermediate walls.

G. Fastening Ceiling Units: Fasten units to supports by welds at twelve inches on center maximum. Grind welds to an appearance acceptable to the Architect. Provide rods, steel angles, and steel channels to support ceiling system per manufacturer's recommendation.

H. Comply with AWS requirements and procedures for manual shielded metal arc welding appearance and quality of welds, and methods used in correcting welding work.

I. Weld side laps of adjacent units between supports at a maximum spacing of 36 inches o.c. Keep the interiors of cells to be used as raceways free of welds having sharp points or edges.

J. Reinforcement at openings: Provide additional metal reinforcement and closure pieces as required for strength, continuity of ceiling and support of other work shown.

K. Caulk all joints at ceiling support system, at the intersection of ceiling and vertical wall, at gaps where Divisions 15 and 16 work cut into the ceiling, with security sealant to prevent concealment of contraband. See Division 7 for sealant description.

L. Installed ceiling system shall not allow passage (or storage) of contraband through longitudinal or transverse panel joints. Manufacturer shall provide and Contractor shall install means of closure to meet approval of Architect to prevent panel gaps and contraband passage and storage.

3.3 CLEANING

A. Touch-up Painting: After installation, wire brush, clean and paint scarred areas, welds and rust spots on top and bottom surfaces of ceiling and supporting steel members.

B. Touch-up galvanized surfaces with galvanizing repair paint applied in accordance with manufacturer's instruction.

C. Touch-up painted surfaces with same type of shop paint used on adjacent surfaces.

D. Return items that cannot be touched-up in the field to the shop, make required alterations, and refinish the entire unit or provide new units.

E. Finish Painting: Underside of ceiling units and visible elements of the support system shall be primed for application of finish paint, color to be selected by Architect and applied as part of the Work of specification Section 09 91 2.

END OF SECTION

SECTION 09 65 13
RESILIENT BASE (RB)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Resilient Base (RB), as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials
   2. ASTM E648 Standard Test Method for Critical Radiant Flux of Floor-Covering Systems Using a Radiant Heat Energy Source
   3. ASTM E662 Standard Test Method for Specific Optical Density of Smoke Generated by Solid Materials
   4. ASTM F1861 Standard Specification for Resilient Wall Base

B. National Fire Protection Association (NFPA):
   1. NFPA 253 Standard Method of Test for Critical Radiant Flux of Floor Covering Systems Using a Radiant Heat Energy Source
   2. NFPA 258 Recommended Practice for Determining Smoke Generation of Solid Materials

C. Thermoplastic Rubber: Type TP.

D. Critical Radiant Flux:
   1. Class I, not less than 0.45 W/cm2.

E. Flame Spread: Maximum, 75.

F. Smoke Developed: Maximum, 250.

1.3 SUBMITTALS

A. Samples:
   1. Resilient Base:
      a. Three samples of material and color as specified in Drawing I-001 Interior Notes & Finish Legend.
   2. Field fabricated corners: Construct sample base inside and outside corner:
      a. Include minimum 4 FT straight base each direction from corner.
      b. If not acceptable construct additional corners.
         1) Stress whitening and cracking will not be acceptable.
         2) Color and height variation will not be acceptable.
      c. Sample corners constitute standard of quality for actual construction.
      d. Maintain sample corners during construction.
      e. Remove when directed.
      f. Sample corners may be built into permanent construction provided sample area is readily identifiable during construction.
      g. Do not proceed with base installation until sample corners are approved by Architect.

B. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data:
      a. See Section 01 78 23.

3. Interior finish fire performance data:
    a. Provide for each finish material and type specified:
        1) Manufacturer's printed information including:
            a) Fire class.
            b) NFPA test number.
            c) Photograph.
        2) Proof of purchase.
        3) See Section 01 78 26.

1.4 EXTRA MATERIAL

A. 20 LF of each color and type of base for maintenance.

1.5 WARRANTY

A. Remove and replace defective areas to satisfaction of Architect at no additional expense to Owner.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Resilient base (RB):
    1. Base:
        a. Johnsonite.

B. Contoured resilient base (RB-1):
    1. Base:
        a. Johnsonite.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Resilient Base (RB-2):
    1. Rubber top set, coved type.
    2. 1/8 x 4 IN, 1/4 IN wide at bottom.
    3. Field formed external and internal corners.
    4. Provide continuous rolls, minimum 95 FT long.

B. Resilient Base (RB-2) at carpet:
    1. Rubber top set, straight type.
    2. 1/8 x 4 IN.
    3. Field formed external and internal corners.
    4. Provide continuous rolls, minimum 95 FT long.

C. Contoured resilient base:
    1. Johnsonite, Millwork Series:
        a. Profile: Millwork.
        b. Size: 7. 5 x 0.25 IN.
        c. Profile: Overlook.

D. Leveling compound: As recommended by manufacturer, compatible with adhesives.

E. Adhesives and primers:
    1. As recommended by manufacturer.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces for defects and irregularities.

B. Verify substrates are free of materials that may affect adhesion.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

D. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

A. Fill cracks, joints, etc., with water resistant non-crumbling patching compound.

B. Trowel to smooth and proper level.

3.3 INSTALLATION

A. Install after wall finishes.

B. Install prior to carpet and acoustical material.

C. Prepare substrate in accordance with manufacturer’s instructions.

D. Protect adjacent work from damage.

E. Schedule installation to minimize accumulation of air contaminants that cannot be removed prior to occupancy.

F. Install base after wall material has dried out thoroughly.
   1. Provide base at intersections of floor and vertical surfaces in areas scheduled to receive base, where intersection is exposed to view.
   2. Apply primer and adhesive as recommended by manufacturer.
   3. Set base straight and true.
   4. Fit base neatly into breaks and recesses.
   5. Install corners as recommended by manufacturer.
   6. Scribe to trim at door frames.
   7. Make joints tight.
   8. Install with top and bottom edges in firm contact with wall and floor.

3.4 CLEANING

A. Remove surplus adhesive immediately after application and rolling.

B. Clean in accordance with manufacturer's recommendations after materials have sufficiently seated.

END OF SECTION

SECTION 09 65 19
RESILIENT TILE FLOORING (RT)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Resilient Tile Flooring (RT) in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM F1700 Standard Specification for Solid Vinyl Tile.
   2. ASTM D2047 Measuring Static Coefficient of Friction of Flooring Finishes

1.3 SUBMITTALS

A. Samples:
   1. Three samples of each material specified in Drawing I-001 Interior Notes and Finish Legend.
   2. Resilient Base:
      a. Field-fabricated corners: Construct sample base inside and outside corner:.
         1) Include minimum 4 FT straight base each direction from corner.
         2) If not acceptable construct additional corners.
            a) Stress whitening and cracking will not be acceptable.
            b) Color and height variation will not be acceptable.
         3) Sample corners constitute standard of quality for actual construction.
         4) Maintain sample corners during construction.
         5) Remove when directed.
         6) Sample corners may be built into permanent construction provided sample area is readily identifiable during construction.
         7) Do not proceed with base installation until sample corners are approved by Architect.

B. Contract Closeout Information:
   1. Maintenance data.
      a. See Section 01 78 23.
   2. Warranty.

1.4 EXTRA MATERIAL

A. Provide 2 cartons of each type, color or size specified.

1.5 WARRANTY

A. Provide written warranty that material will be free from manufacturing defects for a period of five (5) years from date of purchase.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Luxury Vinyl Tile (RT):
   1. Base:
      a. Shaw Contract

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 RESILIENT TILE PRODUCTS

A. Luxury Vinyl Tile (RT):
   1. Clear, unfilled, polyurethane-coated, 0.020 IN thick PVC wear layer over printed film on an intermediate layer over filled vinyl backing.
   2. ASTM F1700 Class III, Type B – Embossed Surface.
   3. Critical Radiant Flux, per ASTM E648 / NFPA 253: Class I, not less than 0.45 W/cm2.
   4. Smoke Developed: 450 or less per ASTM E662 / NFPA 258.
   5. Minimum Static Load Limit: 250 PSI.
   6. Nominal Total Thickness: 0.125 IN gauge.
   7. Nominal Size:
      a. 18 x 18 IN Tiles.
   8. Base Product: Jeogori - by Shaw Contract.

2.3 RESILIENT STAIR TREAD PRODUCTS

A. Resilient Stair Treads and Risers (RST):
   1. ASTM F2169 Type TS, Standard Specification for Resilient Stair Treads.
   2. Color: As selected by architect.
   3. Static coefficient of friction: 0.6.
   4. Nose type: _____.
   5. 2 - 3/4 IN abrasive strips near nose.

2.4 MISCELLANEOUS PRODUCTS

A. Leveling Compound:
   1. As recommended by manufacturer:
      a. Compatible with adhesives.
      b. Moisture resistant.
      c. Non-crumbling.

B. Primers and Adhesive (general-use):
   1. As recommended by flooring manufacturer.

C. Transition Strip:
   1. Nominal Size: 1/8 x 1 IN plain color homogeneous vinyl with backing.
   2. Use tapered profiles where abutting material is of different thickness.

D. Water Vapor Emission Control System: Section 07 16 05.

2.5 EXTRA MATERIAL

A. General:
   1. Provide materials in clearly labeled containers.

B. Quantities of Extra Material Required:
   1. Resilient Tiles: One full carton of each type, color and pattern of material for maintenance.
   2. Resilient Base: 15 LF of each color and type of base for maintenance.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces for defects, irregularities and conditions under which flooring and base are to be installed.

B. Verify substrates are free of materials that may affect adhesion.

C. Identify cracks and other surface defects which need repair prior to application of floor system.

D. Inspect substrate for markers, paint and similar materials used for layout by others and take remedial action as necessary to remove layout line work to prevent bleed-through.

E. Verify floors are level or meet indicated slope.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.

B. Prepare substrate in accordance with manufacturer's instructions.

C. Fill construction joints and other non-moving joints with product approved by manufacturer of flooring system.

D. Where Resilient Tile Flooring abuts thicker finish flooring materials, feather leveling compound for approximately 15 IN for each 1/8 IN of rise so finished surfaces align.

E. Coordinate leveling with vapor emission control system provider.

3.3 INSTALLATION

A. Install flooring in accordance with manufacturer's recommendations.

B. Install flooring wall to wall before the installation of equipment, movable partitions, etc.
   1. Extend flooring into toe spaces, door recesses, closets, and similar openings.

C. If required, install flooring on pan-type floor access covers.
   1. Maintain continuity of color and pattern within pieces of flooring installed on covers.
   2. Adhere flooring to the subfloor around covers and to covers.

D. Scribe, cut, and fit to permanent fixtures, columns, walls, partitions, pipes, outlets, and built-in furniture and cabinets.

E. Lay tile in patterns indicated.
   1. All directional tile shall be installed in the same direction, north and south.
   2. Layout resilient flooring to provide equal size at perimeter.
   3. Adjust layout as necessary to reduce the amount of resilient flooring which is cut to less than half full width.

F. Bond tile to floor, flush, tight accurate seams, and in true alignment with adjacent tiles and with finished surface.

G. Provide tiles in one room or area from one production run.

H. Minimize accumulation of air contaminants that cannot be removed prior to occupancy.

I. Install appropriate transitions.
   1. Install reducer strips at exposed edges.
   2. Install accent transition strip where tile color changes or floor finish material changes to sheet vinyl or sheet rubber:
   3. Locate transition strip directly under closed door position where seam occurs in door openings.
   4. Utilize transition strip specified in respective section where abutting materials are carpet, ceramic tile, quarry tile, stone tile etc.

J. Roll each row when finished and roll total floor when completed.
   1. Roll floor in both directions.
   2. Roll with device and weight recommended by maker of tiles to ensure that the underside mat surface is fully bonded to the glue and sub-floor.
   3. Avoid over-rolling.

3.4 ADJUST AND CLEAN

A. Immediately after application and rolling, remove surplus adhesive.

B. Clean floors in accordance with manufacturer's recommendations.

C. Protect with non-staining building paper to prevent dirt and damage.

D. Protect traffic areas with fiberboard or plywood.

END OF SECTION

SECTION 09 66 13
PORTLAND CEMENT TERRAZZO (TERR)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Portland Cement Terrazzo, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Contractor Qualifications:
   1. Manufacturer-certified applicator with skilled mechanics having not less than three (3) years satisfactory experience in installation of the type of system specified.
   2. Current contractor member in good standing with the National Terrazzo Mosaic Association (NTMA).

B. Material and Installation Standards:
   1. Specifications and standards of National Terrazzo and Mosaic Association (NTMA).

1.3 SUBMITTALS

A. Shop Drawings:
   1. Layout of divider strips.
      a. Details of base and divider strip installation.

B. Samples:
   1. Three (3) samples 12 IN square of each material specified in Drawing I-001 Interior Notes and Finish Legend.
   2. Full range of colors for Architect selection.

C. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data:
      a. See Section 01 78 23.
   3. Interior finish fire performance data:
      a. Provide for each finish material and type specified:
         1) Manufacturer's printed information including:
            a) Fire class.
            b) NFPA test number.
            c) Photograph.
         2) Proof of purchase.
         3) See Section 01 78 26.

1.4 WARRANTY

A. Provide written three (3) year warranty that terrazzo will not spall, crack or visually deteriorate.

B. Warranty signed jointly by Installer and Contractor.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Terrazzo Materials:
   1. Base:
      a. As noted.

B. Bonding Agent:
   1. Base:
      a. Toch Brothers.
      b. Thiokol Chemical.

C. Sealer:
   1. Base:
      a. Hillyard.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Terrazzo:
   1. 1/2 IN thick Portland cement matrix with aggregate.
   2. Bonded directly to structural concrete slab.
   3. Minimum 70 percent face area of aggregate after grinding.

B. Portland Cement:
   1. ASTM C150, Type I.
   2. Obtain cement from a single source for all work of one color.
   3. Color: White, for terrazzo matrix.

C. Sand:
   1. ASTM C33.

D. Water:
   1. Clean, potable.

E. Aggregate:
   1. Natural, sound, crushed marble chips without excessive flats or flakes.

F. Matrix pigments:
   1. Pure mineral or synthetic pigments, resistant to alkalis and non-fading.

G. Curing Compound:
   1. ASTM C309, Type 1 or 1D.

H. Sealer:
   1. Colorless, non-slip, stain resistant penetrating sealer which will not disturb color or physical properties of terrazzo surface.
   2. Hillyard, Onxy-Seal 11.

I. Cleaner: As recommended by sealer manufacturer.

2.3 MATERIALS FOR TERRAZZO BONDED DIRECT TO STRUCTURAL SLAB

A. Divider Strips:
   1. Angle or T-type, depth and style as required.
   2. Width:
      a. Thickness suitable for use.
   3. White alloy zinc.

B. Accessory Strips:
   1. Match width, material and color of divider strips.

C. Control Joint Strips:
   1. Double units, with 1/8 IN wide filler laminated between strips.
   2. Same material and color as divider strips.
   3. Filler: Black neoprene.

D. Bonding Agent:
   1. Two component polysulfide modified epoxy adhesive for bonding thin-set terrazzo:
      a. Toch Brothers; Epotox.
      b. Thiokol Chemical; PE Bonding Agent

E. Divider Strip Adhesive:
   1. Trowelable mixture of fine sand and bonding agent, specially compounded for this use.

2.4 MATERIALS FOR TERRAZZO ON MORTAR BED

A. Divider Strips:
   1. 1-1/4 IN straight type with anchoring device.

B. Accessory Strips:
   1. Match width, material and color of divider strips.

C. Control Joint Strips:
   1. Double units, 1-1/4 IN deep with 1/8 IN wide filler laminated between strips.
   2. Same material and color as divider strips.
   3. Filler: Black neoprene.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.

B. Verify substrates are free of materials that may affect adhesion.

C. Identify cracks and other surface defects which need repair prior to application of floor system.

D. Inspect substrate for markers, paint and similar materials used for layout by others and take remedial action as necessary to remove layout line work to prevent bleed-through.

E. Verify floors are level or meet indicated slope.

F. Do not proceed with installation until unsatisfactory conditions have been corrected.

G. Installation indicates acceptance of substrates and responsibility for performance.

3.2 PREPARATION

A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.

B. Select aggregate and pigments to produce terrazzo to match specified plate.

C. Install divider and accessory strips where indicated, in accordance with manufacturer's instructions and without voids below strips.

D. Place control joint strips over control joints in structure below and on centerline of beams below.

E. Form integral, coved base with top bead and divider strip maximum of 2 IN from integral coved base; provide divider strips at same interval as floor.

F. Provide control and expansion joints where indicated.

3.3 INSTALLATION OF TERRAZZO DIRECT TO STRUCTURAL SLAB

A. Acid etch substrate to remove curing compounds or other substances detrimental to bond.

B. Do not slush substrate with neat cement.

C. Apply bonding agent in accord with manufacturer's instructions.

D. Place terrazzo immediately while bonding agent is still tacky.

3.4 INSTALLATION OF TERRAZZO ON MORTAR BED

A. Thoroughly saturate concrete subfloor with water, slush and broom with neat cement paste.

B. Install mortar bed and screed level to terrazzo thickness below finished floor elevation.

C. Place divider, accessory and control joint strips in plastic cement.

D. Place terrazzo.

3.5 CURING AND FINISHING

A. Cure until topping will not be lifted during grinding.

B. Grout and grind cured terrazzo.

C. Finish by fine grinding as required to match sample.

D. Clean in accord with sealer manufacturer's instructions.

E. Apply two (2) coats of sealer per manufacturer's instructions.

3.6 PROTECTION

A. Provide non-staining protection for finished flooring until building is ready for occupancy.

3.7 FINAL CLEANING

A. Clean floors as recommended by manufacturer just prior to occupancy.

END OF SECTION

SECTION 09 67 23
RESINOUS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. This Section includes epoxy resin flooring. See drawings and finish schedule for locations.

1.2 REFERENCES

A. American Society for Testing and Materials (ASTM)
   1. ASTM C-413 –Test Method for Absorption of Chemical Resistant Mortars, Grouts and Monolithic Surfacing.
   2. ASTM C-579 –Test method for Compressive Strength of Chemical-Resistant Mortars, Grouts and Monolithic Surfacing.
   3. ASTM D-635 –Test Method for Rate of Burning and/or Extent and Time of Burning self-supporting Plastics in Horizontal Positions
   4. ASTM D-638 –Standard Test Method for Tensile Properties of Plastics.
   5. ASTM D-790 –Test Method for Flexural Properties of Unreinforced and Reinforced Plastics and Insulating Materials.
   6. ASTM D-1044 –Test Method for Resistance of Transparent Plastics to Surface Abrasion.
   7. ASTM D-2240 –Test Method for Rubber Property-Durometer Hardness.
   8. ASTM E-831 –Standard Test Method for Linear Thermal Expansion of Solid Materials by Thermo-mechanical Analysis.

1.3 SUBMITTALS

A. Submit list of projects similar in nature which have been installed by applicator during the last 3 years, identified with project name, location, the name of owner's representative, phone number and date of project.
   1. Copy of single warranty covering labor and material for a period of at lest 2 full years is required.

B. System Data: Submit manufacturer's specifications on cured system and individual components of the Resinous Flooring Systems, including physical properties and performance properties and tests specified and submit Material Safety Data Sheets. Each individual component of the system will be evaluated on the basis of these standards. For any test not listed in the manufacturer's standard nationally published data, the manufacturer must supply the missing data accompanied by the independent testing laboratory's test results that prove compliance in accordance with the referenced standard(s). Comply with the requirements of Section 01 340.

C. Samples: The contractor shall submit two (2) 6" x 6" cured system samples for each product that the contractor has made for verification purposes and color/non-skid finish texture approval.

1.4 QUALITY ASSURANCE

A. Installer Qualifications
   1. Applicator shall be approved by the epoxy resin-flooring manufacturer. Engage an installer who has successfully completed within the last three years at least three resinous flooring applications similar in type and size to that of this project and who will assign mechanics from these earlier applications to this project, of which one will serve as lead mechanic.

1.5 DELIVERY, STORAGE AND HANDLING

A. Deliver materials to job site, check for completeness of order and for shipping damage.

B. Store materials in dry, enclosed area protected from exposure to moisture and sunlight. Maintain temperature of storage area between 60 and 90 degrees F.

1.6 PROJECT CONDITIONS

A. Concrete must meet the project specification prior to starting the project.

B. Concrete shall have cured 30 days.

C. Concrete shall not have any chlorides, fibermesh additives, curing compounds or concrete sealers.

D. Concrete shall have a steel trowel smooth finish.

E. Job area shall be free of other trades during and for a period of 24-48 hours after epoxy resin flooring installation.

1.7 WARRANTY

A. Furnish a single, written warranty covering both material and workmanship for a period of two full years from date of installation.

PART 2 - PRODUCTS

2.1 SHOP-FLOOR SYSTEM BY DUR-A-FLEX, INC. OR EQUAL PRODUCTS BY DEX-O-TEX OR GENERAL POLYMER

A. Epoxy Resin Flooring System, minimum 1/8” thick system comprised of:
   1. Self-leveling, 100% solids, tinted, epoxy formulation including resin, hardener, reactive flow enhancers, and finely graded natural aggregates.
   2. Quartz silica aggregate for broadcasting.
   3. Two-component, 100% solid tinted epoxy sealer.
   4. Two component, aliphatic pigmented polyester urethane solvent based seal coat.
   5. Color: As indicated on drawings and Section 09 200 –General Color and Finish Material Notes.
   6. Texture: “Medium Grit”.

B. Physical/Chemical Characteristics:
   1. Compressive Strength: ASTM C-579. 12,400 psi.
   2. Tensile Strength: ASTM D-638, 4,000 psi
   3. Flexural Strength: ASTM D-790, 6,250 psi
   4. Hardness: ASTM D-2240, Shore D Hardness 80-85
   5. Abrasion Resistance: ASTM D-1044, Tabor Abrader 1000 cycles; 0.08 gram weight loss.
   6. Flammability: ASTM D-635; self extinguishing, maximum ¼” burn
   7. Thermal Coefficient of Linear Expansion: ASTM E-831
   8. Water Absorption” ASTM E-638; 0.1%

2.2 DUR-A QUARTZ FLOORING SYSTEM BY DUR-A-FLEX, INC. OR EQUAL PRODUCTS BY DEX-O-TEX OR GENERAL POLYMER.

A. Epoxy Resin Flooring System, minimum 1/8” thick system comprised of:
   1. Two-component penetrating epoxy primer.
   2. Self-leveling, 100% solid epoxy Dur-A-Glaze #4 including resin, hardener, reactive flow enhancers and finely graded colored aggregates.
   3. Quartz silica aggregate for broadcasting.

B. Physical/Chemical Characteristics:
   1. Compressive Strength: ASTM C-579, 12,400 psi
   2. Tensile Strength: ASTM D-638, 4,000 psi.
   3. Flexural Strength: ASTM D-790, 6,250 psi.
   4. Hardness: ASTM D-2240, Shore D Hardness 90-85.
   5. Abrasion Resistance: ASTM D-1044, Taber Abrader 1000 cycles; 0.08 gram weight loss.
   6. Flammability: ASTM D-635; self extinguishing, maximum ¼” burn.
   7. Thermal Coefficient of Linear Expansion: ASTM E-831.

8. Water Absorption: ASTM D-638; 0.1%

PART 3 - EXECUTION

3.1 SUBSTRATE PREPARATION

A. Provide concrete using a shot-blast machine for surface removal and etching. All surface laitance, curing compounds, oil, grease or other surface contaminants shall be removed.

3.2 MATERIAL INSTALLATION

A. To ensure a minimum of 1/8” thickness by the broadcast method, the aggregate must be broadcast into the wet Dur-A-Glaze $4 Shop floor resin a minimum of three (#) separate times. Applicators seeking approval to put fewer broadcasts down must take a core sample from a spot(s) randomly selected by the Architect. Owner and architect shall take random core samples to ensure minimum 1/8” thick floor system. The core hole(s) shall be patched at no charge. If the floor fails to meet 1/8” thick, another aggregate coat must be applied.

B. The floor surface shall be applied so as to have a coarse, non-skid texture appropriate for wet, slippery areas. All epoxy surfaces shall be inspected for appropriate texture and approved by the Owner’s designated construction manager or Architect.

C. Install in accordance with manufacturer’s written instructions.

D. Remove all unused materials from the job site.

3.3 DETAILS

A. In areas where the installed floor does not abut a vertical surface, make a straight saw cut ¼” in depth and chip back the inner surface.

B. Slight spalling and minor concrete repairs are to be repaired with a mixture of Dur-A-Glaze #4 and a mixture of finely graded sand aggregates.

C. Install saw cut expansion joints in locations designated by Architect. Fill expansion joints with Elast-O-Coat. For control joints, fill flush with epoxy flooring system.

END OF SECTION

SECTION 09 67 26
SEAMLESS EPOXY FLOORING (SEF)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Seamless Epoxy Flooring (SEF), as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Manufacturer installer or installer trained and certified by manufacturer for installation of system specified.
   2. Minimum five (5) years experience in application of specified materials for projects of similar size and complexity.

B. Materials:
   1. Recommended and manufactured by single supplier to insure compatibility and proper chemical and mechanical bond.

C. ASTM International (ASTM):
   1. ASTM C413 Standard Test Method for Absorption of Chemical-Resistant Mortars, Grouts, Monolithic Surfacings, and Polymer Concretes
   2. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Plastics in a Horizontal Position
   3. ASTM D695 Standard Test Method for Compressive Properties of Rigid Plastics
   4. ASTM D2047 Standard Test Method for Static Coefficient of Friction of Polish-Coated Flooring Surfaces as Measured by the James Machine
   5. ASTM D2240 Standard Test Method for Rubber Property—Durometer Hardness
   6. ASTM D2370 Standard Test Method for Tensile Properties of Organic Coatings
   7. ASTM D3960 Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings
   8. ASTM D4060 Standard Test Method for Abrasion Resistance of Organic Coatings by the Taber Abraser
   9. ASTM D4541 Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
   10. ASTM D7234 Standard Test Method for Pull-Off Adhesion Strength of Coatings on Concrete Using Portable Pull-Off Adhesion Testers

D. American National Standards Institute (ANSI):
   1. ANSI/NFSI B101.1 Test Method for Measuring Wet SCOF of Common Hard-Surface Floor Materials

E. Mockup:
   1. Prior to commencing work, install a 100 SF sample on job of specified color and texture.
   2. Approved mockup will serve as standard for work on project.

F. Preinstallation Meeting:
   1. Set up by GC with Client and Architect.

1.3 SUBMITTALS

A. Product Data:

B. Samples:
   1. Three samples 12 IN square of each material specified in Drawing I-001 Interior Notes and Finish Legend.
   2. Samples for review of color and texture.

C. Project Information:
   1. Verification of installer qualifications.
   2. Minutes from Preinstallation Conference.

D. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data:
      a. See Section 01 78 23.

1.4 WARRANTY

A. Written warranty signed by Manufacturer and Installer against defects and wear for a period of five (5) years, including but not necessarily limited to:
   1. Delamination from substrate.
   2. Loss of aggregate.
   3. Degradation of finish.
   4. Cracking and spalling.
   5. Water penetration.

B. Deliver Warranty to Owner upon completion of installation.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Seamless Epoxy Flooring (SEF):
   1. Base:
      a. Tnemec
   2. Optional:
      a. General Polymers, Sherwin-Williams.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Seamless Epoxy Flooring System:
   1. Nominal 3/16 IN flooring system consisting of 100 percent solids clear epoxy and multicolored, fine grain, ceramic-coated quartz aggregate.
   2. Components: Primer coat, base coat with combination of high solids epoxy, multicolored quartz aggregates, mortar coat and topcoat.
   3. Primer and Coating :
      a. Volatile Organic Compound (VOC): 0.05 LB/GAL
      b. Abrasion Resistance: 18 mg/loss.
      c. Coating Strength: 732 PSI, concrete failure
      d. Adhesion to Concrete: 450 PSI, concrete failure
      e. Coefficient Of Friction (COF): 0.63
      f. Wet Static Coefficient Of Friction: 0.94
      g. Compressive Strength: 13,500 PSI
      h. Flammability: Self-extinguishing
      i. Tensile Strength: 8,000 PSI

j. Elongation: 5 percent
k. Konig Hardness: 171.3
l. Shore D hardness: 80-85 at 0 SEC
m. Water Absorption: less than 0.2 percent
n. Color: See I-001.

4. Base Product: StrataShield Decorative Quartz Series 222 Deco-Tread.
5. Locations to be used:
   a. Locations as indicated per IN-Series.

B. Primer:
   1. Two component, Urethane Modified C0ncrete

C. Base Coat:
   1. Medium build clear epoxy consisting of two component, high solids, clear epoxy with quartz aggregate for application.
   2. Aggregate:
      a. Material: Ceramic coated quartz.
      b. Size-graded, blended to achieve specified texture and color.
      c. Color: As indicated on I-001 Interior Notes and Finish Legend.

D. Base Product:
   1. Series 222 Deco-Tread Base.
   2. Broadcast Coat:
      a. Epoxy sealer.
      b. Color: Clear.
   3. Base Product:
      a. Series 284 Deco-Clear Grout Coat.

E. Topcoat:
   1. Clear Urethane.
      a. Color: Clear.
   2. Base Product: Series 248 Everthane Clear.

F. Accessory Strips:
   1. Depth and style as required.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces for defects, irregularities and conditions under which flooring is to be installed.

B. Verify floors are level or meet indicated slope.

C. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 b16 05 Water Vapor Emission Control System.

B. Prepare substrate in accordance with manufacturer’s instructions.

C. Fill cracks, construction joints and other non-moving joints with elastomeric sealant.

D. Mask and cover adjacent surfaces, fixtures, cabinetwork, equipment, and similar items not receiving coating.

3.3 INSTALLATION

A. Install accessory strips at base and edge terminations in adhesive, or use concealed mechanical anchorages.

B. Apply floor coating system in accordance with manufacturer's instructions.

C. Apply quartz aggregate for specified finish.
   1. Uniform Non-skid.

D. Install cove base to height of 4 IN with 1 IN radius cove.
   1. Install base to painted wall surface.
   2. Trowel apply vertical base coat and hand sand.
   3. Apply resin to assure a smooth surface and cove.
   4. Do not allow resin to puddle in cove.
   5. Seal top edge of base.

E. Apply topcoat uniformly over surfaces to satin finish.

F. Finish Work:
   1. Match approved samples.
   2. Uniform in thickness, sheen, color, pattern, and texture.
   3. Free from defects detrimental to performance.

3.4 PROTECTION

A. Provide non-staining protection for finished flooring until building is ready for occupancy.

3.5 FINAL CLEANING

A. Clean floors as recommended by manufacturer just prior to occupancy.

END OF SECTION

SECTION 09 67 81
CONCRETE FLOOR SEALER (CFS-ND)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Concrete Floor Sealer (CFS-ND), as indicated, in accordance with provisions of the Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Applicator Qualifications:
   1. Licensee of manufacturer, or approved in writing.

B. ASTM International (ASTM):
   1. ASTM C309 Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete
   2. ASTM C1315 Standard Specification for Liquid Membrane-Forming Compounds Having Special Properties for Curing and Sealing Concrete

1.3 SUBMITTALS

A. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data:
      a. See Section 01 78 23.

1.4 WARRANTY

A. Written warranty signed jointly by applicator and manufacturer.

B. Manufacturer's standard warranty for material performance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Concrete Floor Sealer – Normal Duty (CFS-ND):
   1. Base:
      a. L&M Construction Chemicals.
   2. Optional:
      a. Dayton Superior

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Concrete Floor Sealer – Normal Duty (CFS-ND):
   1. Water-based, low VOC, acrylic copolymer solutions that cure, seal and dustproof concrete with minimal yellowing.
   2. Conform to ASTM C1315, Type I, Class B.
   3. VOC compliant.
   4. Meet local air quality regulations.
   5. Minimum Solids Content: 30 percent by volume.

6. Primer: As recommended by manufacturer.
7. Base Product:
   a. Dress & Seal WB 30 by L&M.

PART 3 - EXECUTION

3.1 INSPECTION

A. Cure concrete minimum of 28 days.

B. Verify concrete is free of fins, ridges, voids and suitable to accept installation.

C. Installation constitutes acceptance of responsibility for performance.

3.2 PREPARATION

A. Verify curing agents used are compatible with coating system or completely remove.

B. Remove dirt, dust, oil, grease, asphalt and foreign matter.

C. Patch holes or voids.

D. Rout out cracks exceeding 1/16 IN wide and caulk.

E. Caulk non-moving joints up to 1 IN wide with suitable backer and sealant.

F. Do not caulk or overcoat joints where movement exceeds 25 percent or joints over 1 IN wide.

3.3 INSTALLATION

A. Do not apply to surfaces scheduled to receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.

B. Apply in accordance with manufacturer's recommendations; minimum 2 coats.
   1. Apply first coat at not over 400 SF/GAL.
   2. Apply subsequent coat not over 400 SF/GAL.

C. Allow no traffic on sealed surface for 72 hours after application.

3.4 PATCHING AND CLEANING

A. Patch areas which fail to match adjacent work.

B. Broom clean surface after completion of work.

END OF SECTION

SECTION 09 68 13
CARPET TILE (CPTT)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Carpet Tile (CPTT) in accordance with provisions of the Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Carpet manufacturer shall have no less than ten (10) years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicates compliance of products with requirements of this section.

B. Contractor Qualifications:
   1. Firm with not less than five (5) years of successful carpeting experience similar to work of this section and recommended and approved by the carpet manufacturer. Upon request, submit letter from carpet manufacturer stating certification qualifications and acceptance.

C. Installer Qualifications:
   1. Mill trained, skilled mechanics supervised by experienced superintendent with 50,000 yards experience.

D. Single Source Responsibility:
   1. Provide product material by a single manufacturer for each carpet type specified.

1.3 SUBMITTALS

A. Samples:
   1. Three samples 12 IN square of each material and color specified in Drawing I-001 Interior Notes and Finish Legend.

B. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data:
      a. See Section 01 78 23.

1.4 WARRANTY

A. Written warranty for replacement of damaged or defective carpet or carpet stained by adhesives for a period of two (2) years.

B. Written warranty that material will not significantly degrade for a period of fifteen (15) years due to the following:
   1. Exposure to normal light shall not affect colorfastness as measured by AATCC 16E.
   2. Exposure to normal atmospheric contaminates.
   3. Excessive wear resulting in reduction of pile height by more than 15 percent in any area or pulling out of nap.
   4. Delamination from face structure and shrinkage or stretching affecting performance of face or backing structure or causing tile to curl or dome.
   5. Edge ravel.

C. Warranty to include removal, replacement, and disposal of defective carpet.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Carpet Tile (CPTT):
   1. Base:
      a. As noted for individual types under Carpet Types on Sheet I-001.

B. Carpet Edging Strips:
   1. Base:
      a. BurkeMercer.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Carpet Tile (CPTT):
   1. First quality, no seconds or imperfects.
   2. Deliver with mill register numbers attached.
   3. Comply with applicable state and local codes.
   4. Antimicrobial;
      a. Broad spectrum efficacy against bacteria and fungus for the life of the product.

B. Carpet Edging Strips:
   1. Base Product: Carpet to Resilient Transition 170 by BurkeMercer.
   2. Thickness to match carpet.
   3. Color as selected by Architect.

C. Adhesive:
   1. Non-staining, non-bleeding strippable type.
   2. As recommended by carpet manufacturer.

2.3 CARPET TYPES

A. As specified in Interiors Notes and Finish Legend on Sheet I-001 and as called out on IN-series.

2.4 EXTRA MATERIAL

A. Furnish Owner with minimum of five (5) percent additional material of each type, pattern and color for maintenance purposes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrate to accept installation.

B. Verify concrete floor surfaces are suitable for Carpet Tile installation.
   1. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.

C. Patch or fill cracks and irregularities on granolithic terrazzo marble ceramic subfloors.
   1. Fill grout lines with approved latex patching compound.

3.2 PREPARATION

A. Thoroughly clean areas to receive carpet tile, strip waxes and finishes.

B. Thoroughly remove dust and vacuum, wet mop then seal concrete.

C. Patching Compound :
   1. Fill cracks, joints, holes or uneven areas with non-crumbling latex base floor filler.

2. Acceptable Product: Lev-L-Astic.
3. Do not mix with water.

D. Prior to commencement of work, test area with adhesive and carpet tile to determine open time and bond.

E. Layout:
1. Arrange joints symmetrically about centerline of rooms.
2. Lay so pile and pattern of adjacent pieces match.
3. Verify dimensions.

3.3 INSTALLATION

A. General:
1. Comply with manufacturer's instructions and recommendations for uniformity of direction, seam locations, and lay of carpet pile.
2. Install carpet under open bottom obstructions and under removable flanges and furnishings, and into alcoves and closets of each space.
3. Provide cut outs where required.
   a. Conceal cut edges with protective edge guards or overlapping flanges.
4. Run carpet under open-bottom items such as heating convectors.
5. Install tight against walls, columns, cabinets and over recessed door closers.
6. Install edge guard at openings and doors wherever carpet terminates, unless indicated otherwise.
7. Make clean cuts in accordance with manufacturer's recommendation.
8. Butt edges to produce tightest joint possible without distortion.
9. Fill or level floors at uneven areas with leveling compound and feather minimum 4 FT- 0 IN.
10. Where carpet tiles abut thicker finish flooring materials, feather leveling compound for approximately 12 IN for each 1/8 IN of rise so finished surfaces align.
11. Expansion joints:
    a. Do not bridge building expansion joints with continuous carpeting.
    b. Provide for movement.

B. Install in accordance with manufacturer's instructions.
1. Adhesive must have recommended flash time before carpet is positioned.
2. Do not mix dye lots in same area.
3. Install carpet tiles with arrows pointing in same direction
   a. Verify ‘grain’ direction with Architect.

C. Install carpet edging strips, transition strips, reducer strips, at non-carpeted floor surface.
1. Install with contact adhesive.
2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.

D. Install according to Architect's directions for overall patterns and borders.
1. Install carpet patterns according to drawings without deviation.
2. Develop templates as required.

3.4 CLEAN

A. Remove spillage of adhesive from face or seam using remover provided by manufacturer.

B. Remove loose threads with broadloom scissors.

C. Remove spots.

D. Completely and thoroughly vacuum using pile lifter.

E. Save cuts over 9 IN for Owner stock.

F. Advise Owner regarding care and maintenance.

3.5 PROTECTION

A. Protect carpet subject to traffic with nonstaining building material paper runners or other approved material.

B. Protect installation from rolling traffic with sheets of hardboard or plywood.

C. Maintain carpet protection on each floor or area until accepted.

3.6 INSPECTION

A. Inspect installation and verify work is complete and properly installed.

END OF SECTION

SECTION 09 68 16
BROADLOOM CARPET (CPT)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Broadloom Carpet (CPT), as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Ten (10) years of production experience with carpet similar to type specified in this document; and whose published product literature clearly indicates compliance of products with requirements of this section.

B. Installer Qualifications:
   1. Five (5) years of successful carpeting experience similar to work of this section and recommended and approved by carpet manufacturer.
   2. Upon request, submit letter from carpet manufacturer stating certification.
   3. Mill trained, skilled mechanics supervised by experienced superintendent with 50,000 yards experience.

C. Single Source Responsibility:
   1. Provide product material by a single manufacturer for each carpet type specified.

D. Fire and Smoke Compliance:
   1. Comply with DOC FF-1-70, standard for surface flammability of Carpets and Rugs.
   2. Critical Radiant Flux, per ASTM E648 and NFPA 253:
      a. Class I, not less than 0.45 W/cm2.
   3. Smoke Developed:
      a. 450 or less per ASTM E662 / NFPA 258.

E. Comply with DOC FF-1-70, standard for surface flammability of Carpets and Rugs.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Carpet pattern and edging drawings, seaming diagram, pattern direction, indicate location of different patterns of carpet, indicate locations of any threshold conditions.
   2. Submit templates if applicable for carpet patterns.

B. Samples:
   1. Three samples 12 IN square of each material and color specified in Drawing I-001 Interior Notes and Finish Legend.

C. Project Information:
   1. Certification that manufacturer of specified products is engaged in a recognized products stewardship program and will take back used product for closed loop recycling.

D. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data:
      a. See Section 01 78 23.
   3. Interior finish fire performance data:
      a. Provide for each finish material and type specified:
         1) Manufacturer's printed information including:

a) Fire class.
b) NFPA test number.
c) Photograph.

2) Proof of purchase.
3) See Section 01 78 26.

1.4 EXTRA MATERIAL

A. Provide minimum of five (5) percent additional material of each type, pattern and color for maintenance purposes.

1.5 WARRANTY

A. Replace damaged or defective carpet or carpet stained by adhesives for a period of two (2) years.

B. Warrant material will not degrade for ten (10) years due to following:
1. Delamination from face structure, shrinkage or stretching affecting performance of face or backing structure or causing tile to curl or dome.
2. Reduction of pile height by more than 10 percent in any area.
3. Colorfastness to normal light as measured by AATCC 16E.
4. Normal atmospheric contaminates.
5. Pulling out of nap.
6. Edge ravel.

C. Warranty to include removal, replacement carpet, installation, and disposal of defective carpet.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Broadloom Carpet (CPT):
1. Base:
a. As specified in Drawing I-001 Interior Notes and Finish Legend.

B. Carpet Edging Strips:
1. Base:
a. BurkeMercer.

C. Other Materials:
1. As noted.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Broadloom Carpet (CPT):
1. First quality, no seconds or imperfects.
2. Low, high density pile, of non-absorbent fiber; total height of carpet, maximum 3/8 IN .
3. Backing shall not contain PBDEs (polybrominated diphenyl ethers).
4. Dye lots: One per type.
5. Nylon specification:
a. Performance certification testing from Fiber Manufacturer is required.
6. Antimicrobial:
a. Broad spectrum efficacy against bacteria and fungus for the life of the product.
7. Soil/stain blocking treatment.
8. Carpet backing shall not contain polybrominated diphenyl ethers (PBDE).

B. Carpet Edging Strips:
1. Base Product: Carpet to Resilient Transition 170 by BurkeMercer.
2. Thickness to match carpet.
3. Color as selected by Architect.

C. Leveling Compound:
   1. Non-crumbling, non-staining, cementitious type.
   2. Mix with latex milk not water.
   3. Ardex K-15.

D. Adhesive:
   1. Non-staining, non-bleeding, type as required by carpet manufacturer compatible with concrete sealer, seam sealer, and seam cleaner.
   2. As recommended by carpet manufacturer with VOC content no greater than 50 g/L.
   3. Seam Sealer: Hot-melt product or as recommended by carpet manufacturer for sealing seams and butting cut edges at backing to form secure seams and to prevent pile loss at seam.
   4. Allow removal of carpet without damage or adherence to carpet.

2.3 CARPET TYPES

A. See material and color specified in Drawing I-001 Interior Notes and Finish Legend.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify concrete floor surfaces are suitable for Carpet Tile installation.

B. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.

3.2 PREPARATION

A. Clean areas to receive carpet tile.
   1. Strip waxes and finishes.
   2. Vacuum and wet mop.

B. Patching Compound :
   1. Fill cracks, joints, holes or uneven areas with non-crumbling latex base floor filler.
   2. Acceptable Product: Lev-L-Astic.
   3. Do not mix with water.

C. Layout:
   1. Arrange seams symmetrically at centerline of rooms and as indicated on seaming diagrams.
   2. Use minimum of cross seams or visible side seams.
   3. Lay and match adjacent carpet for pile and pattern directions.
   4. Install in longest practicable lengths.
   5. Do not piece.

3.3 INSTALLATION

A. Install carpet patterns in accordance to layouts indicated in Drawings.
   1. Develop templates as required.

B. Comply with manufacturer's instructions and recommendations for uniformity of direction, seam locations, and lay of carpet pile.
   1. Do not mix dye lots in same area.
   2. Locate seams to avoid traffic direction at doorway, center seams under door.
   3. Install carpet under open bottom items, removable flanges, furnishings, alcoves and closets.
   4. Install tight against walls, columns, cabinets and over recessed door closers.
   5. Butt edges tight without distortion.
   6. Where carpet abuts deeper finish flooring materials, feather leveling compound for approximately 12 IN for each 1/8 IN of rise so finished surfaces align.
   7. Fill or level floors at uneven areas with leveling compound and feather minimum 4 FT- 0 IN.

8. Expansion joints:
    a. Do not bridge building expansion joints with continuous carpeting.
    b. Provide for movement.

C. Install carpet edging strips, transition strips and reducer strips at non-carpeted floor surface.
    1. Conceal cut edges with protective edge guards or overlapping flanges.
    2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.

3.4 CLEAN

A. Remove spots and adhesive from face or seams in accordance with manufacturer recommendations.

B. Vacuum using pile lifter.

C. Advise Owner regarding care and maintenance.

END OF SECTION

SECTION 09 69 00
ACCESS FLOORING

PART 1 - GENERAL

1.1 SUMMARY

A. Provide labor, materials, tools, equipment, and services for Access Flooring, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. System shall perform in accordance with panel size, pedestal height and data specified elsewhere as a minimum requirement.

B. System shall comply with all applicable codes. Where conflict occurs, the most stringent shall apply.

C. Manufacturer and Installer must have at least five (5) years experience in manufacturing and installing the system.

1.3 SYSTEM PERFORMANCE

A. Panels must be capable of supporting a uniform load of 1,000 lb. placed on a square inch area at any location on the panel with a maximum top surface permanent indentation not to exceed 0.10”. Axial load on pedestals no less than 6,000 lb.

B. Panels shall be capable of supporting a uniform load of 250 lb. place on a one square foot area any place on the floor with a maximum deflection of 0.060”.

C. Ultimate strength of the floor system shall provide a loading capacity of 3,250 lb. without failure, the point where panel will no longer accept the load.

D. Deformation for rolling load of 600 lb. shall not exceed 0.040” with a 1 ½” wide wheel for 10,000 passes.

E. Panels and supporting understructure shall withstand without failure an impact load anywhere on the panel of 100 lb. dropped from a height of 36” with one inch square area denter.

F. Panel shall withstand an ultimate load of 1,500 lb. with a cut out of 10 ½” square within the interior of the panel.

G. Class A Flame Spread Rating per ASTM E-84.

1.4 SUBMITTALS

A. Provide shop drawings showing layout of the floor. Take field dimensions of space utilities and all other items that may affect the installation. Show specific details of the following:
   1. Floor plan.
   2. Under stud partition.
   3. Where partial panel meets wall.
   4. Panels under millwork.
   5. Where door intersects panels.

B. Submit samples of panel, pedestal to explain system.

C. Submit carpet samples for evaluation and color selection.

D. Provide three (3) copies of maintenance manuals showing method of installation, access to panels for reconfiguration and all such clear instruction to permit the Owner to make changes without destroying the integrity of the system. Provide lifting device if required to access system.

1.5 TEST METHOD

A. Test method for required loads shall be in accordance with the "Recommended Test Procedures for Access Floors" as published by CISCA, Ceiling and Interior Systems Construction Association and performed by an independent testing laboratory. Submittal of test results is required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Access Flooring:
   1. Base:
      a. Tate Access Floor
   2. Optional:
      a. Computer Environments, Inc.
      b. Interface AR

2.2 MATERIALS

A. Access floor system shall consist of nominal 24" square modular panels supported on all sides by pedestals located at each corner.

B. System based on Con Cor Panel 24 with Posilock Understructure by Tate Access Floors. Systems meeting this specification and manufacturer by the following are acceptable:
   1. Computer Environments Inc.
   2. Interface AR

C. Panels consist of a top and a bottom sheet steel formed by welded edges and filled with lightweight cementitious material. Panel nominal 24" x 24". Panel to have tab to interface with pedestal head for alignment. Panels secured to pedestals with machine screws. Panels finished in electrically conducive epoxy paint.

D. Panel shall have capability of positioning and accurately securing carpet tiles without the use of adhesive except at panel edge where cut to fit.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine subfloor for unevenness or irregularities that could affect the access floor installation. Do not proceed until corrections are made.

B. Refer to shop drawings and make field check of conditions before beginning work. Verify location of incoming utility and environmental lines, pipes, ducts in floor and walls before laying out work.

C. Layout pedestal locations to permit electrical work to proceed with installation.

END OF SECTION

SECTION 09 72 16
VINYL WALL COVERING (VWC)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Vinyl Wall Covering, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Surface-Burning Characteristics, per ASTM E84:

B. Quality Standard for Vinyl Coated Fabric Wall Covering: CFFA-W-101B.
   1. Provide mildew resistant products.
   2. CFFA-W-101-D and FS CCC-W-408D.
      a. Type II, Medium.

C. Wall Covering, Vinyl Coated: FS CCC-W-408D-94.

D. Mockup:
   1. Install a full wall panel with outside corner application in area designated by Architect.
   2. Panels reviewed by Architect will serve as standard of quality for comparison.
   3. Replace unacceptable panels.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer’s literature indicating material in compliance with specifications.

B. Samples:
   1. Three samples 12 IN square or pieces large enough to include repeat of pattern of each type, pattern and color, from manufacturers full line as specified in Drawing I-001 Interior Notes and Finish Legend.

C. Contract Closeout Information:
   1. Maintenance data:
      a. See Section 01 78 23.
   2. Interior finish fire performance data:
      a. Provide for each finish material and type specified:
         1) Manufacturer's printed information including:
            a) Fire class.
            b) NFPA test number.
            c) Photograph.
         2) Proof of purchase.
         3) See Section 01 78 26.

1.4 EXTRA MATERIAL

A. Provide 10% of total SQ FT of each type, color or size specified.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Vinyl wall covering (VWC):
   1. Base: As selected.

B. Clear Corner Guard (CCG):
   1. Base:
      a. Tri-Guards.
   2. Option:
      a. InPro Corporation; Clear Corner Guard.
      b. Construction Specialties, LG-034.
      c. Koroguard; Lexan Corner Guard.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Vinyl Wall Covering (VWC):
   1. Class A fire rating, UL labeled.
   2. Per ASTM E84:
      a. Flame spread: Maximum 25.
      b. Fuel contributed: Maximum 25.
      c. Smoke developed: Maximum 25.
   3. Backing Material:
      a. Osanburg.
   4. Colors and patterns as indicated on Sheet I-001.

B. Adhesive:
   1. Manufacturer's recommended type for use with selected materials, mildew resistant, non-staining type.

C. Primer Sealer:
   1. As approved by adhesive and wall covering manufacturers.

D. Plastic Corner Trim:
   1. Extruded plastic trim.
   2. Use wherever wall covering either changes color or pattern or terminates at a corner.
   3. Provide full height floor to ceiling unit.
   4. 3/4 X 3/4 IN corner unit.
   5. Color: Clear.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Examine substrate and conditions under which material is to be installed.

B. Before installation, test surfaces with moisture meter.

C. Install when moisture is within paint manufacturer's acceptable limits.

D. Start of work indicates acceptance of responsibility for performance and required remedial work.

E. Install fabric in accordance with manufacturer's directions.
   1. Make joints invisible with seams butted.
   2. Use panels in order as they are cut from rolls, use rolls in consecutive order.

F. Install vertically, unless Architect instructs otherwise.
   1. Keep seams at least 6 IN away from corner.

2. Remove air bubbles, wrinkles and blisters.
3. Where color or pattern changes, or vinyl terminates at an exterior corner, install corner trim.
4. At wall control joints, material is to be continuous and tucked into joint.

G. Remove switch and wall plates, and surface-mounted fixtures.
1. Cut wall covering to fit.
2. Replace items after completion of work.

H. Trim smooth, non-match patterns on wall by double cutting through both thicknesses.

I. Carefully match deeply textured or match patterns.

J. Trim selvages to assure color and pattern match.

K. Install before installation of casings, bases, cabinets, etc.

L. Install above and below windows, above doors in sequence.

M. Remove excess adhesive.

END OF SECTION

SECTION 09 77 23
FABRIC-WRAPPED PANELS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Fabric-Wrapped Panels, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. ASTM International (ASTM):
   1. ASTM E84 Test Method for Surface Burning Characteristics of Building Materials.
   2. ASTM C423 Standard Test Method for Sound Absorption and Sound Absorption Coefficients by the Reverberation Room Method

1.3 SUBMITTALS

A. Shop Drawings:
   1. Fabrication details for fabric-wrapped panels.
   2. Plans and elevations showing size and location of each panel.

B. Product Data:
   1. Manufacturer's literature indicating material in compliance with specifications.

C. Samples:
   1. Two samples 12 IN square or 12 IN long pieces of each type of mounting, fabric facing and core material as specified in Drawing I-001 Interior Notes and Finish Legend.

D. Contract Closeout Information:
   1. Maintenance data:
      a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Base:
   1. Decoustics.

B. Optional:
   1. Sound Soak by Armstrong.
   2. Conwed Designscape by Owens Corning.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Fabric:
   1. Fire test response characteristics:
      a. Flame spread: 25 or less. Class A.
      b. Smoke developed: 450 or less.
   2. Acoustically transparent, 100 percent polyester.
   3. Width: Minimum 54 IN.
   4. Repeat: Non-matching; reverse hang alternate panels.

5. Factory applied stain repellent finish treatment.
6. Color and pattern as scheduled in Section 09 06 00 Room Finish and Color Schedule.

B. Acoustical Wall Panels (AWP)
1. Acoustical Panel (AP) by Decoustics.
2. 6 to 7 LBS/CU FT medium density fiberglass panel with resin hardened edges.
3. Fabric covered.
4. 1 IN thick (NRC 0.85).

C. Concealed Z-clip Mounting:
1. Metal panel-clip and base support bracket system consisting of 2-part panel clips, with one part mechanically attached to back of panel and other part attached to wall substrate.
2. Resin harden panel at location of panel clip attachment.
3. Brackets designed to support full weight of panels.
4. System designed to allow panel removal.

D. Adhesive Mounting:
1. Mechanically attach impaling clips to wall at 24 inches on center each way and within 2 inches of each panel edge.
2. Affix panel to wall with adhesive recommended by manufacturer.

2.3 FABRICATION

A. Edge Profile:
1. Square.

B. Chemically harden mounting locations of backing board.

C. Wrap fabric around backing board to cover face and edges, free from waves in fabric weave, wrinkles, sags, blisters, visible seams, and adhesive or other foreign matter.
1. Stretch fabric to fit snugly and return a minimum of 1 IN on backside of backing board.
2. Corners shall be tailored to eliminate visible wrinkles, darting, and puckers.

D. Fabricate panels to exact sizes required for fit and to dimensional tolerances of 1/16 IN for thickness, edge straightness, overall length and width, and square from corner to corner.

PART 3 - EXECUTION

3.1 PREPARATION

A. Examine substrates for compliance with requirements for installation tolerances and other conditions affecting panel performance.

B. Correct defects and proceed with installation after unsatisfactory conditions have been corrected.

C. Start of installation constitutes acceptance of substrate and responsibility for performance.

3.2 INSTALLATION

A. Install fabric-wrapped panels in locations indicated with vertical surfaces and edges plumb, with horizontal surfaces and edges level, aligned as indicated from panel to panel, and scribed to fit adjoining work accurately.
1. Variations from plumb and level shall not exceed plus or minus 1/16 IN.
2. Variations of butt joints from hairline shall not be more than 1/16 IN.

3.3 CLEANING AND PROTECTION

A. Clip loose threads, and remove pills and extraneous materials from fabric wrappings.

B. Upon completion of installation, clean fabric facings in accordance with the fabric manufacturer's written instructions, to remove dust and other foreign materials.

C. Provide and maintain protection of installed panels in a manner acceptable to the fabric manufacturer and panel installer, to ensure that fabric-wrapped panels are without damage or deterioration at Project completion.

D. Replace damaged or deteriorated panels that cannot be cleaned and repaired.

END OF SECTION

SECTION 09 91 23
INTERIOR PAINTING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Interior Painting, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Definitions:
1. "Paint" and "painting" refer to applied coatings, except Section 09 96 59, Section 09 91 13, and Section 07 19 16.
2. Finished room or space: Room or space indicated to receive a finish on Drawing I-001 Interior Notes & Finish Legend.
3. Mechanical work: Work included in Mechanical Specification Divisions.
4. Electrical work: Work included in Electrical Specification Divisions.

B. Work Included:
1. Interior surfaces in finished rooms or spaces, unless indicated not to be painted or indicated to be painted under other sections.
2. Mechanical and electrical work:
   a. Interior mechanical and electrical equipment not completely factory finished.
   b. In finished rooms and spaces: Exposed ductwork, piping, insulated piping, conduit, busways, raceways, and associated accessories.
   c. Where duct surfaces are visible through grilles or diffusers, paint visible surfaces of ducts flat black.

C. Surfaces Not to be Painted:
1. Anodized aluminum, stainless steel, chromium plate, glass, copper, bronze or similar materials.
2. Moving parts of valves, operating units, motor and fan shafts, sending devices or mechanical and electrical parts such as valve and damper operators.
3. Code labels, such as UL, FM that are mylar or flat, non-embossed plates.
   a. Embossed plates and labels stamped into frames are to be painted.
   b. Information shall be readily visible and convenient for identification by authority having jurisdiction.
4. Equipment identification or rating plates.

D. Factory Finishing of Wood Items Specified Elsewhere:
1. Wood Veneer Faced Casework and Panel Products: See Section 12 32 00.
2. Flush Wood Doors: See Section 08 14 16.

E. Standard of Workmanship:
1. Before proceeding, finish following items with specified materials for approval as standard of quality for completed work:
   a. One room in each basic color scheme.

F. ASTM International (ASTM):
1. ASTM D2486 Standard Test Method for Scrub Resistance of Interior Latex Flat Wall Paints.
2. ASTM D2805 Standard Test Method for Hiding Power of Paints by Reflectometry.

1.3 SUBMITTALS

A. Product Data:
   1. Manufacturer's data for each paint system specified.

B. Samples:
   1. Three 8 1/2 IN x 11 IN samples of each color and finish as noted in Drawing I-001 Interior Notes and Finish Legend.
   2. Gloss samples.

C. Contract Closeout Information:
   1. Maintenance data:
      a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Paints:
   1. Base:
      a. Sherwin-Williams

B. Stains and Varnishes:
   1. Base:
      a. Sherwin-Williams

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Manufacturers listed as noted in Drawing I-001 Interior Notes and Finish Legend are for color reference only.

B. Provide paint products from one manufacturer as far as possible.

C. Paints and Stain Systems:
   1. Paint, stain, and coating systems listed are Sherwin Williams unless noted otherwise.
   2. By application:
      a. See Part 3.

D. Gloss range: As indicated for paint systems when measured in accordance with ASTM D523:
   1. Flat: Below 15, at 85-degrees.
   2. Eggshell: Between 5 and 20, at 60-degrees.
   3. Satin: Between 15 and 35, at 60-degrees.
   4. Semi-gloss: Between 30 and 65, at 60-degrees.
   5. Gloss: More than 65, at 60-degrees.

E. Colors:
   1. As noted in Drawing I-001 Interior Notes and Finish Legend and as indicated in Section 20 05 53.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine surfaces for defects and correct to prevent unsatisfactory results.

B. Verify compatibility of intermediate and topcoat finishes applied over surfaces primed by others.

C. Commencement of work constitutes acceptance of surfaces and responsibility for performance.

D. Do not paint items having complete factory finish with exception of items noted in Drawing I-001 Interior Notes and Finish Legend and as indicated in Section 20 05 53.

3.2 PREPARATION

A. Verify surfaces are clean, dry and free of foreign materials which will affect adhesion or appearance.

B. Remove mildew and neutralize surface.

C. Eliminate efflorescence before painting.

D. Prior to painting, test surfaces with moisture meter.
   1. Paint when moisture is within paint manufacturer's acceptable limits.

E. Wood:
   1. Sand surfaces receiving finish with 180-grit, or finer sand paper.
      a. Remove fingerprints and marks.
      b. Produce smooth texture.
      c. Prepare grain to receive finish.
   2. Remove dust.
   3. Opaque Finishes:
      a. Back prime wood trim with penetrating sealer.
      b. Seal knots, pitch and resinous sapwood.
   4. Stain and Clear Finishes:
      a. Treat wood with compatible washcoat prior to stain application.
      b. Putty nail holes and minor defects, to match finish wood color.

F. Ferrous Metal and Hollow Metal:
   1. Follow requirements of SSPC SP1 and SP3 except where higher preparation levels are indicated.
   2. Wire brush, or grind as necessary to remove shoulders at edge of sound paint to prevent telegraphing.
   3. Touch up damaged shop coats.
   4. Caulk hollow metal frame joints, corner seams, intersections of rabbets, stops, and soffit joints prior to painting.

G. Galvanized Metal and Non-anodized Aluminum:
   1. Follow requirements of SSPC SP1 except where higher preparation levels are indicated.
   2. Treat surfaces with galvanized surface cleaner as recommended by primer and topcoat manufacturer.

H. Gypsum Wallboard:
   1. Repair minor irregularities.
   2. Avoid raising nap of paper.
   3. Apply prime coat.
   4. Correct areas showing defects after application of primer.
   5. Re-prime refinished areas.

I. Concrete and Masonry:
   1. Repair minor defects.
   2. Remove oil from concrete.
   3. Block Filler:
      4. Comply with manufacturer’s recommended coverage rates for conditions encountered.
      5. Provide complete cover with recommended coating system.
      6. Fill pinholes and minor surface defects.
      7. Apply by brush, roller or sprayer.
         1) Back-roll spray applied filler with roller or squeegee.

3.3 APPLICATION

A. Remove and protect hardware, accessories, plates, fixtures, finished work, and similar items, or provide ample in place protection.

B. Touch up abraded areas of shop prime coats, suction or hot spots in plaster, gypsum wallboard, concrete block, and concrete before painting.

C. Provide coverage to hide.
   1. Evenly spread and smoothly flow on for full, smooth cover.
   2. Apply additional coats where undercoats show until paint film is of uniform finish and color.

D. Back prime wood trim with penetrating sealer.

E. Apply additional coats in accordance with manufacturer's instructions.

F. Finish closets and semi-exposed surfaces to match nearest adjoining surfaces.
   1. Include surfaces behind grills.

G. Upon completion of painting, replace removed items and remove protection.

3.4 PROTECTION AND CLEANUP

A. Provide WET PAINT signs.

B. Protect adjacent work from damage by painting and finishing work.

C. Remove temporary protective wrappings, after completion of operations.

D. Clean, repair or replace, and repaint damaged work.

3.5 INTERIOR PAINT SYSTEMS

A. Concrete and Concrete Block Walls:
   1. Latex (PNT), Gloss Level 3, Eggshell:
      a. Sherwin-Williams:
         1) Prime coat: Loxon Concrete & Masonry Primer.
         2) Intermediate coat: Harmony Interior Latex Eg-Shel.
         3) Topcoat: Harmony Interior Latex Eg-Shel.
   2. Epoxy (PNTE), Gloss Level 6, Gloss:
      a. Sherwin-Williams:
         1) Prime coat: Loxon Concrete & Masonry Primer.
         2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
         3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.

B. Gypsum Wallboard and Plaster Surfaces, Walls:
   1. Low Odor (PNT), Gloss Level 3, Eggshell:
      a. Sherwin-Williams:
         1) Prime coat: Harmony Interior Latex Primer.
         2) Intermediate coat: Harmony Interior Latex Eg-Shel.
         3) Topcoat: Harmony Interior Latex Eg-Shel.
   2. Epoxy (PNTE), Gloss Level 6, Gloss:
      a. Sherwin-Williams:
         1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
         2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
         3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.

C. Gypsum Wallboard - Ceilings and Soffits:
   1. Low Odor (PNT), Gloss Level 1, Flat:
      a. Sherwin-Williams:
         1) Prime coat: Harmony Interior Latex Primer.
         2) Intermediate coat: Harmony Interior Latex, Flat
         3) Topcoat: Harmony Interior Latex, Flat.
   2. Epoxy (PNTE), Gloss Level 3, Eggshell:
      a. Sherwin-Williams:
         1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.

2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.
3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Eg-Shel.

D. Metal Stairs, Handrails, Guardrails and Miscellaneous Metals - Ferrous, Primed, Zinc-coated, and Aluminum:
1. Water based urethane, Gloss Level 6, Gloss:
a. Sherwin-Williams:
1) Prime coat: Pro Industrial Pro-Cryl Universal Primer.
2) Intermediate coat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.
3) Topcoat: Pro Industrial Water Based Catalyzed Epoxy, Gloss.

E. Duct Surfaces Visible Through Grilles or Diffusers:
1. Interior Latex Gloss Level 1 Flat:
a. Sherwin-Williams:
1) Prime coat: ProMar 200 Zero VOC Interior Latex Primer.
2) Topcoat: ProMar 200 Interior Latex, Flat.
a) Color: Black.

F. Metal Doors and Frames:
1. Waterborne acrylic, Gloss Level 5 Semi-gloss:
a. Sherwin-Williams:
1) Prime coat: Pro Industrial Pro-Cryl Universal Primer.
2) Intermediate coat: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss.
3) Topcoat: Pro Industrial Pre-Catalyzed Water Based Epoxy, Semi-Gloss.

G. Painted Wood:
1. Gloss Level 3, Eggshell:
a. Sherwin-Williams:
1) Prime coat: Premium Wall & Wood Primer.
2) Intermediate coat: ProMar 200 Zero VOC Interior Latex Eg-Shel.
3) Topcoat: ProMar 200 Zero VOC Interior Latex Eg-Shel.

H. Stained Wood:
1. Stain:
a. Sherwin-Williams:
1) Wood Classics 250 Interior Oil Stain.
2. Clear intermediate and topcoats:
a. Premium quality.
1) Comply with current edition of AWI Architectural Woodwork Quality Standards.
b. Sheen:
1) Measured with 60 degree gloss meter.
2) Satin: 31 to 45 points.
c. Apply product in 2 coats.
1) Lightly sand between coats.
d. Polyurethane based Varnish:
1) Sherwin-Williams:
a) Wood Classics Polyurethane Varnish.

END OF SECTION

SECTION 09 96 23
GRAFFITI - MOISTURE PROTECTION SURFACE SEALER

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Graffiti – Moisture Protection Surface Sealer, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Applicator must be licensed by manufacturer, or approved in writing.

B. ASTM D2369 Standard Test Method for Volatile Content of Coatings.

C. Mockup:
   1. Minimum 4 FT x 4 FT area on each surface type.
   2. Coordinate location with Architect.
   3. Apply in accordance with Manufacturer's recommendations and instructions.
   4. Allow protective treatment cure before testing inspection.
   5. Keep test panels available for comparison throughout protective treatment project.
   6. Accepted test area may be included in work.

1.3 SUBMITTALS

A. Contract Closeout Information:
   1. Maintenance data.
      a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Graffiti - Moisture Protection Surface Sealer:
   1. Base:
      a. PROSOCO, Inc.
   2. Optional:
      a. L&M Construction Chemicals.
      b. Hydrozo.
      c. Chemprobe.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Graffiti - moisture surface sealer:
   1. Penetrating, clear, solvent-based silicone elastomer.
   2. UV stable.
   3. Total solids: 9 percent minimum.
   4. VOC Content: Comply with USEPA AIM VOC regulations (40 CFR 59.403).
   5. Base Product: Sure Klean Custom Masonry Sealer by PROSOCO.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.
   1. Bring holes, voids, and cracks to Architect's attention.

B. Application constitutes acceptance of responsibility for performance.

3.2 PREPARATION

A. Verify concrete was steel troweled, hair broomed, and free of fins, ridges and voids.

B. Assure curing agents are compatible with sealer or completely removed.

C. Concrete must be cured for minimum of 28 days, with moisture content not exceeding 8 percent.

D. Remove surface contamination by cleaning or if necessary by sandblasting.

E. Repair, holes, voids, and cracks.

F. Apply test patch.
   1. If test patch indicates lack of adhesion, re-prepare surface.

3.3 APPLICATION

A. General:
   1. Apply in accordance with Manufacturer's recommendations and instructions.
   2. Do not apply to surfaces scheduled to receive cementitious coatings or toppings, such as concrete, terrazzo, polyester or epoxy coatings.

B. Spray Application:
   1. Apply sealer wet-on-wet and saturate from bottom up, creating a 6 IN to 8 IN rundown below spray contact point.
   2. Allow first application to penetrate 2 - 3 minutes.
   3. Resaturate surface with sealer.
   4. Spray in overlapping X-pattern to fluted surfaces to ensure coverage of recessed surfaces.
   5. Reduce rundown to 4 IN to 6 IN below contact point when applying to burnished, ground face or similar smooth surfaces.

C. Brush or Roller Application:
   1. Apply sufficient material to thoroughly saturate surface.
   2. Avoid excessive overlapping.
   3. Brush out non-penetrating heavy runs and drops.
   4. Dense Surfaces:
      a. Apply a single coat to wet surface without creating drips, puddles or rundown.
      b. Do not over apply.
   5. Porous Surfaces:
      a. Apply 2 coats.
      b. Apply second coat within 2 hours of first coat, or first coat is dry to touch.

D. Protect treated surfaces from rain for 4-6 hours.

3.4 PATCHING AND CLEANING

A. Recoat areas which fail to match adjacent work.

B. Remove debris resulting from these operations.

END OF SECTION

DIVISION 10

SPECIALTIES

SECTION 10 14 06
IDENTIFICATION DEVICES - INTERIOR

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Identification Devices - Interior, as indicated, and described in this Section.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Americans with Disabilities Act (ADA):
   1. ADA Standards for Accessible Design

B. American National Standards Institute, (ANSI):
   1. ICC/ANSI A117.1-2003.

C. Underwriters Laboratories (UL)

1.3 SUBMITTALS

A. Shop Drawings:
   1. Fabrication and installation drawings for identification device types.
      a. Large scale drawings of major components.
      b. Include dimensioned plans, elevations, and full scale details of identification device wording and lettering layout.
   2. Field verify dimensions and locations for identification device types prior to developing shop drawings.
   3. Furnish location template drawings for items supported or anchored to permanent building construction.

B. Samples:
   1. Laser output proof of full character set, or sets with a minimum upper case height of 2 IN.
   2. Full scale pen plot of each identification device legend.
   3. Full-size spacing templates for building mounted letters and numbers.
   4. Full-size sample letter required for identification device types in specified typeface, materials, and finish.
      a. Where possible, provide on the actual background material.
   5. Minimum 6 IN x 6 IN sample of materials for identification device types.
   6. Minimum 6 IN x 6 IN sample of colors requiring color matches on samples of actual identification device material.
   7. Prototypes:
      a. Fabricate one (1) prototype of each identification device type for verification and testing after shop drawing and sample submittals are approved, and prior to fabrication.
      b. Submit clarification drawings detailing scale, materials, finishes, fasteners, etc. for section prototypes for review and approval prior to fabrication.

C. Contract Closeout Information:
   1. Warranty.
   2. Operating and Maintenance Data.
      a. See Section 01 78 23.
   3. Spare parts.
      a. See Section 01 78 43.

1.4 WARRANTY

A. Manufacturer shall warrant workmanship and materials for a period of two (2) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Identification Devices - Interior:
   a. Base:
      1) ASI Sign Systems.
      2) JP Cooke

2.2 IDENTIFICATION DEVICES

A. General:
   1. The following information is from Owner Standards for each sign type:
      a. Individual component and accent materials.
      b. Letter style, case and height.
      c. Character proportions.
      d. Letter colors.
      e. Braille, etched letters and other special requirements.
      f. Background color and other graphics.
      g. Mounting method and shims or spacers used.
      h. Location of sign relative to other building elements.
      i. Finish level.
   2. Letters shall conform to the following proportional standard:
      a. The font width of the uppercase letter “O” shall be 55 percent minimum and 110 percent maximum of the height of the uppercase letter “I”.
      b. Stroke thickness of the uppercase letter "I" shall be 10 percent minimum and 30 percent maximum of the height of the character.
   3. Tactile lettering shall conform to the following standards:
      a. Character height measured vertically from the baseline of the character shall be 5/8 IN minimum and 2 IN maximum based on the height of the uppercase letter “I”.
      b. Stroke thickness of the uppercase letter "I" shall be 15 percent maximum of the height of the character.
      c. The font width of the uppercase letter “O” shall be 55 percent minimum and 110 percent maximum height of uppercase letter “I”.
      d. Maintain minimum 1/8 IN font separation between all characters.
   4. Braille characters shall conform to the following standard:
      a. Braille characters shall be separated from adjacent raised characters or symbols 1/2 IN.
      b. Grade 2 Braille translation to be provided by identification device manufacturer.
   5. Direction and identification devices for communications systems: International Symbols.

B. Identification Device Types:
   1. ARA– Area of Refuge Assistance
      a. Construction:
         1) Tactile photopolymer plaque with raised text and Braille
   2. ARAD– Area of Refuge Assistance – Accessible Directional
      a. Construction:
         1) Acrylic panel with acrylic backplate
   3. ARAI – Area of Refuge - Illuminated
      a. Construction:
         1) Fabricated aluminum with translucent vinyl graphics
   4. BID – Bed Number ID - Ceiling
      a. Construction:
         1) Acrylic panel with vinyl graphics
   5. BIDP – Bed Number ID - Projecting
      a. Construction:
         1) Acrylic panel with vinyl graphics
   6. CRID – Conference Room ID with Insert
      a. Construction:
         1) Tactile photopolymer panel with updatable acrylic window panel and paper insert

7. DLL – Dimensional Lettering
    a. Construction:
        1) Router cut metal
8. DOL – Directional Overhead - Large
    a. Construction:
        1) Acrylic panel with vinyl graphics
9. DOM – Directional Overhead - Medium
    a. Construction:
        1) Acrylic panel with vinyl graphics
10. DOS – Directional Overhead - Small
    a. Construction:
        1) Acrylic panel with vinyl graphics
11. DWC – Directional – Wall Corner
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
12. DWL – Directional – Wall Large
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
13. DWLM – Directional – Wall Large with Map
    a. Construction:
        1) Modular updatable acrylic message strips and map on a common acrylic backplate
14. DWM – Directional – Wall Medium
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
15. DWS – Directional – Wall Small
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
16. EDR – Directory Elevator / Level:
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
17. EDRB – Directory Elevator back of house
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
18. EDRC – Directory Elevator cab
    a. Construction:
        1) Modular updatable acrylic message strips on a common acrylic backplate
19. EMT– EMTALA
    a. Construction:
        1) Acrylic panel with acrylic backplate
20. EXIT – ADA Exit ID
    a. Construction:
        1) Tactile photopolymer panel on acrylic backplate
21. EVAC – Evacuation Plan Holder
    a. Construction:
        1) Acrylic updatable window panel and paper insert
22. FAC – Facilities Tag
    a. Construction:
        1) Acrylic panel with second surface silkscreened text
23. FEC – Fire Extinguisher Cabinet
    a. Construction:
        1) Acrylic panel with vinyl graphics
24. FIRE– In Case of Fire
    a. Construction:
        1) Acrylic panel with silkscreened text and picto
25. IPE – Info Plaque - Exterior
    a. Construction:
        1) Acrylic panel with acrylic backplate

26. IPL – Info Plaque - Large
    a. Construction:
        1) Acrylic panel with acrylic backplate
27. IPM – Info Plaque - Medium
    a. Construction:
        1) Acrylic panel with acrylic backplate
28. IPS – Info Plaque - Small
    a. Construction:
        1) Acrylic panel with acrylic backplate
29. LLP – Lobby Logo(s):
    a. Construction:
        1) Router cut metal
30. MRIL – Major Room ID - Large
    a. Construction:
        1) Tactile photopolymer panel with updatable acrylic window panel and paper insert
31. MRIS – Major Room ID - Small
    a. Construction:
        1) Tactile photopolymer panel with updatable acrylic window panel and paper insert
32. OID – Office ID:
    a. Construction:
        1) Tactile panel with raised text and Braille
33. OIDB – Office ID for back of house
    a. Construction:
        1) Acrylic panel with silkscreened graphics
34. OIDI – Office ID with Insert
    a. Construction:
        1) Tactile panel with raised text and Braille and updatable paper insert
35. PRID – Patient Room ID
    a. Construction:
        1) Tactile photopolymer panel with modular graphic acrylic panel and patient indicator tags
36. PTML – Projecting ID - Large
    a. Construction:
        1) Acrylic panel with vinyl graphics
37. PTMM – Projecting ID - Medium
    a. Construction:
        1) Acrylic panel with vinyl graphics
38. REG– Regulatory Symbol
    a. Construction:
        1) Acrylic panel with silkscreened picto
39. RID – Room ID
    a. Construction:
        1) Tactile photopolymer panel on acrylic backplate
40. RIDB – Room ID – Back of House
    a. Construction:
        1) Tactile photopolymer panel on acrylic backplate
41. RIDE– Room ID (Exterior Grade)
    a. Construction:
        1) Exterior grade tactile photopolymer panel with raised text and Braille
42. RIDI – Room ID with Insert
    a. Construction:
        1) Tactile photopolymer panel with updatable acrylic window panel and paper insert
43. RRA – Restroom ID:
    a. Construction:
        1) Tactile photopolymer plaque with raised text and Braille
44. RRAB – Restroom ID back of house
    a. Construction:
        1) Tactile photopolymer panel with raised text and Braille

45. RRAS – Restroom ID staff
    a. Construction:
        1) Tactile photopolymer panel with raised text and Braille
46. RRHD – Handicap directional
    a. Construction:
        1) Acrylic panel with decorative accent and silkscreened graphics
47. RRSC – Restroom ID symbol combo (men/women)
    a. Construction:
        1) Circular cut acrylic panel with triangular cut acrylic panel overlay with silkscreened picto
48. RRSR– Restroom ID symbol round (Women)
    a. Construction:
        1) Circular cut acrylic panel with silkscreened picto
49. RRST– Restroom ID symbol triangle (Men)
    a. Construction:
        1) Triangular cut acrylic panel with silkscreened picto
50. SEG– Floor ID / Stair Egress
    a. Construction:
        1) Acrylic panel with silkscreen text
51. SGR01 – Specialty Graphics
    a. Construction:
        1) Pressure sensitive 4 color film with overlaminate
52. SID– Stair ID
    a. Construction:
        1) Tactile photopolymer panel with acrylic graphic panel and picto
53. SIDE– Stair ID (Exterior Grade)
    a. Construction:
        1) Exterior grade tactile photopolymer panel with raised text and Braille
54. TSEP – Tornado Shelter Evacuation - Projecting
    a. Construction:
        1) Acrylic panel with vinyl graphics
55. TSEW– Tornado Shelter Evacuation - Wall
    a. Construction:
        1) Acrylic panel with silkscreened text and picto
56. VGR – Vinyl Graphics
    a. Construction:
        1) Opaque graphic film. First surface application

2.3 IDENTIFICATION DEVICE FINISH LEVEL

A. High Finish:
    1. May include following materials, or combination of materials:
        a. Back-painted, sandblasted glass panel with silkscreened letters.
        b. Etched, paint-filled letters.
        c. Etched stainless steel panel.
        d. Full round bar stock stainless steel letters.
        e. Painted aluminum letters.
        f. Painted aluminum panel.
        g. Painted die-cut vinyl letters.
        h. Water-jet cut stainless steel letters.

B. Medium Finish:
    1. May include following materials, or combination of materials:
        a. Painted acrylic letter.
        b. Painted acrylic panel.
        c. Clear acrylic panel with paper insert.
        d. Painted aluminum panel with reflective die-cut vinyl letters.
        e. Painted photopolymer panel with silkscreened letters.
        f. Scotchprint Panaflex digital vinyl.

C. Finish and contrast:
   1. Characters and background:
      a. Non-glare.
      b. Characters must contrast with background; recommend 70 percent.

2.4 MATERIALS

A. All materials to be inert.

B. Contractor shall ensure and prevent galvanic reactions between products used.

C. Acrylic:
   1. Cast Acrylic Sheet: Cast, not extruded or continuous cast, methyl methacrylate monomer plastic sheet.
      a. Provide in sizes and thicknesses indicated.
      b. Minimum flexural strength: Mean 16,000 PSI when tested in accordance with ASTM-D790.
      c. Minimum allowable continuous service temperature: 176 degF.
   2. General types:
      a. Transparent Sheet: Clear, colorless sheet, matte finish.
         1) Light transmittance: 92% when tested in accordance with ASTM-D1003.
      b. White Translucent Sheet:
         1) Density required to produce uniform brightness and minimum halation effects.
      c. Opaque Sheet:
         1) Colored opaque acrylic sheet in colors and finishes indicated; If not indicated, provide in colors selected from the manufacturer’s full range of standard colors.
         2) 30-30 Acrylic: Tinted.
   3. Edges: Polish edges.
   4. Abrasive Resistance Coating (ARC):
      a. Product: Abrasive resistant coating as recommended by manufacturer.
      b. Apply ARC to exposed faces of acrylic sheet after graphics have been applied.

D. Paints:
   1. Under-coating: Apply paint under-coating for identification devices for deterioration of metals prevention.
   2. Finish:
      a. Evenly spray apply finish in accordance with manufacturer's recommendation.
      b. Finish to be free of grit, dirt, smears, spots, and orange peel effect.
   3. Compatibility: Ensure paint compatible with metal used.
   4. Ultra-violet inhibitors: Each coat shall have UV Inhibitors
   5. Manufacturer: Matthews Paint Company, Pleasant Prairie, WI.

E. Polymer:
   1. Photopolymer:
      a. Sheet photopolymer:
         1) Manufacturer: Nova Polymers Inc., Yeadon, PA.
         2) Product: NovAcryl, PT Series nylon based photopolymer on extruded, clear, UV stable copolyester PETG thermoplastic base.
            a) Model: PT-236.
         3) High resolution, ADA compliant, raised graphic sign.
            a) Minimum face relief: .032 IN in compliance with ADA.
            b) Maximum face relief: .040 IN in compliance with ADA.
         4) Base thickness: 6.0 mm.
         5) Face relief: 1.0 mm Nylon resin based photopolymer layer.
         6) Substrate: Clear PETG plastic base with UV inhibitor.
         7) Photopolymer Durometer: 80 Shore D Durometer hardness.
      b. Process in accordance with manufacture's General Processing Guidelines.
      c. Laminated photopolymers are not acceptable.
      d. Finishes:
         1) Automotive grade acrylic polyurethane finishes.

2) Manufacturer:
a) Base: Matthews Paint Company, Pleasant Prairie, WI.
b) Optional: Carbit Paint, Co, Inc., Chicago, IL
3) Lacquer based finishes are not acceptable.

2. Solid polymer:
a. Material: Solid sheet nonporous polymer, homogeneous filled acrylic.
1) Coated, laminated, or composite construction are not acceptable.
b. Manufacturer:
1) Base: DuPont Corian.
2) Optional:
a) Avonite.
b) Surrell.

F. Vinyl Film:
1. Clear protective vinyl overlayment:
a. Manufacturer:
1) Base: 3M.
a) Scotchcal Matte Overlaminate 8911 ES.
2) Optional: Avery.
a) Avery Protective Clear Matte Vinyl.
b. Description:
1) High durability, UV resistant film with pressure sensitive adhesive.
2) Overlaminate electrostatic imaged graphics, and piezo ink jet printed graphics in accordance with manufacturer recommendations.
3) Adhesive and color: Pressure-sensitive, clear.
4) Liner: Kraft paper.
5) Overlaminate2 mils transparent vinyl.
6) Finish gloss: Matte.
7) Thickness overlaminate and adhesive:

2. Digital image vinyl:
a. Manufacturer:
1) Base: 3M.
a) Controltac Plus Conformable Graphic Film 8620 ES.
2) Optional: Avery.
a) Ink Jet Vinyl: Apply to flat, vertical surfaces with and without rivets, and corrugated and riveted surfaces.
b. Description:
1) Durable, conformable, repositionable and removable vinyl film designed for electrostatic imaging.
2) Produce 4 color graphics with electrostatic and electronic graphics systems.
3) Film: Cast vinyl.
4) Color: White, opaque.
5) Thickness: 2.0 mil without adhesive; Vinyl:
a. Non-reflective film:
1) Opaque sheeting, with repositionable pressure activated adhesive backing.
2) Minimum application temperature40 degF.
3) Maximum application temperature: 100 degF.
4) Exterior exposure life: 7 years when installed in accordance with manufacturer's recommendations.
5) Properties:
a) Adhesion to etched aluminum: 7.0 LBS/IN.
b) Dimensional stability: 1/64 IN.
c) Resistance: No effect at minus 73 degF and 40 degF.
d) Temperature Range: Minus 40 degF to plus 200 degF.
e) Tensile strength: 5 LBS/IN at 73 degF.
f) Thickness: .003 IN to .004 IN.
b. Vinyl Film:
1) Opaque, non-reflective vinyl film with pressure sensitive adhesive backing,

suitable for exterior and interior applications.
2) Thickness: 0.0035 IN minimum.

G. Fasteners and Anchors:
1. Anchors and inserts:
a. Exterior installations, and areas requiring corrosion resistance:
1) Non-ferrous metal or hot-dipped galvanized anchors and inserts.
b. Concrete and masonry work: Toothed steel or lead expansion bolt devices with inserts for drilled-in-place anchors.
2. Bracket mounting:
a. Identification devices which project at right angles from walls or ceilings.
1) Manufacturer's recommended standard concealed brackets, fittings, and hardware.
2) Attach brackets and fittings securely to walls or ceilings with concealed fasteners and anchoring devices in accordance with manufacturer's recommendations.
3. Cast metal: Mount cast plaques using standard method recommended by manufacturer for each type of wall surface.
4. Concealed mounting:
a. Mounting plaques: Insert threaded studs into tapped lugs on back of plaque.
b. Set in predrilled holes filled with quick setting cement.
5. Face mounting: Mount plaques with exposed fasteners anchored through face of plaque into wall surface.
6. Flush mounting: Letters mounted with backs in contact with wall surface.
7. Glass mounting: When mounting identification device panels to front surface of glass, provide .080 IN aluminum backup plate, on inside surface of glass
8. Magnetic tape:
a. Manufacturer: 3M.
9. Mechanical fastening: Manufacturer's recommended fasteners based on identification device type and substrate.
10. Metal letters and numbers:
a. Manufacturer's standard fastening method for letter form, type of mounting, wall construction, and condition of exposure.
b. Heavy paper template: Provided by Manufacturer for establishing letter spacing and for locating holes for fasteners.
11. Projected mounting: Mount letters at a projected distance from the wall surface as indicated.
12. Reclosable fasteners:
a. Manufacturer: 3M.
b. Fastener types.
1) Dual Lock SJ3562, Type 170.
2) Dual Lock SJ3560, Type 250.
3) Dual Lock SJ3561, Type 400.
c. Provide fastener types as recommended by manufacturer.
13. Shim plate mounting:
a. Concealed aluminum shim plates 1/16 IN thick, with predrilled and countersunk holes.
b. Provide at locations indicated, and where other mounting methods are not practicable.
c. Attach shim plate with fasteners and anchors providing secure attachment to substrate.
d. Attach panel identification devices to shim plate and substrate.
14. Wall mounting: Attach panel identification devices to wall surfaces using following methods:
a. Vinyl tape mounting: Double-sided foam tape, thickness indicated, or as required to mount identification devices to smooth, non-porous surfaces.
b. Silicone adhesive mounting:
1) Liquid silicone adhesive recommended by Manufacturer for attaching identification devices to irregular, porous, or vinyl-covered surfaces.
15. Installer requirements:
a. Based on manufacturer recommendations, installer shall be responsible for fastener compatibility with substrates.
b. Insure that oxidation does not occur, or that other reactive processes do not occur between related signage materials and fasteners.

H. Adhesives:
   1. Double faced laminating film:
      a. Manufacture: Fasson, Division of Avery International Company.
      b. Type: FASTAPE A Laminating Film, or as recommended by manufacturer.
   2. Permanent double faced tape:
      a. Manufacturer: 3M.
      b. Type: 1/32 IN, Scotch Mount Neoprene Tape No. 4962, or as recommended by manufacturer.
   3. Removable double faced tape:
      a. Manufacturer: 3M.
      b. Type: 1/32 IN, double faced removable tape No. 4432, or as recommended by manufacturer.
      c. Color: Black.
   4. Silicon adhesive:
      a. Manufacturer: General Electric Corporation.
      b. Type: Silicon paneling adhesive as recommended by manufacturer.
   5. Permanent adhesive:
      a. Manufacturer: 3M.
      b. Scotch 468MP, hi-performance adhesive, or as recommended by manufacturer.
   6. Installer shall ensure adhesive compatibility with substrates.

I. Finishes:
   1. Glass: Non-glare.
   2. Metal finishes: Finish in compliance with NAAMM Metal Finishes Manual for finish designations and application recommendations.
   3. Paint: Satin finish.
   4. Stainless steel: ANSI No. 4 finish, horizontal grain, unless otherwise noted or specified..
   5. All finishes comply with American with Disabilities Act:
      a. Measure finishes with a Glossimeter to insure compliance.

2.5 GRAPHICS

A. Image Process:
   1. Graphic content and style:
      a. Provide identification device copy in compliance with requirements indicated for content, finishes, materials, positions, sizes, spacing, styles, and colors of letters, numbers, symbols, and other graphic images.

B. Typography:
   1. Typography and graphics: Photographically and/or mechanically reproduced.
   2. International Symbols: In accordance with U.S. Department of Transportation current standards publication.
   3. Identification device typeface fonts: Provide as indicated on drawings.
   4. Letter forms:
      a. Use approved type font masters from the original type foundry.
      b. Cut letter forms with Signus equipment, only.
      c. Die cutting: Letter forms edges and corners are to be clean and true.
         1) Letterforms with ragged edges, rounded positive or negative corners will not be acceptable.

C. Braille:
   1. Grade 2 Braille translations by identification device manufacture.

D. Artwork:
   1. Manufacturer provide typesetting, and mechanical artwork required for identification device types.

PART 3 - EXECUTION

3.1 INSPECTION

A. Examine conditions under which materials are to be installed.

B. Installation constitutes acceptance of responsibility for performance.

3.2 FABRICATION

A. General Requirements:
   1. Fabricate and assemble identification devices in shop to the greatest extent possible.
   2. Fabricate parts and assemblies ready for installation at the building site.
   3. Surface defects considered unacceptable: Oil canning, cupping, and warping.
   4. Grind welds shall smooth.
   5. Be responsible for structural stability and mounting for graphics and identification devices.

B. Identification Device Panels:
   1. Comply with requirements indicated for colors, designs, details of construction, finishes, materials, shapes, sizes, and thicknesses.
   2. Surfaces: Smooth, even, and level.
   3. Identification device panel flatness:
      a. Fabricate panels to remain flat within 1/32 IN over the concave surface.
      b. Fabricate panels to remain flat under installed conditions within a tolerance of plus or minus 1/16 IN measured diagonally.
   4. Edge Condition: 90 degree square cut, unless otherwise noted.
   5. Corner condition: Provide square corners, unless otherwise noted.
   6. Panel materials:
      a. See drawings for types and locations.

C. Applied Copy:
   1. Die-cut copy characters from vinyl film.
   2. Provide pressure sensitive adhesive backing.
   3. Apply copy to exposed face of identification device panel.
   4. Apply copy to other surfaces where indicated.

D. Photoetched Copy:
   1. Fabricate raised lettering on metal background using acid etching process.
   2. Metal background for acid etching: Stainless steel or magnesium plate.
      a. Finish metal background as indicated.
      b. Paint raised surface.

E. Engraved Copy:
   1. Graphic elements, letters, numbers, and symbols machine engraved into identification device panel face.
      a. Engrave to a precisely formed copy, incised to uniform depth.
      b. Engrave using high speed cutters, mechanically linked to master template in a pantographic system.
   2. Engraved acrylic: Epoxy enamel fill engraved acrylic copy.
   3. Face engraved clear acrylic:
      a. Epoxy enamel filled engraved copy.
      b. Opaque background color coating shall be applied to back face of acrylic sheet.
      c. Copy shall be engraved to a minimum depth of 1/32 IN, and 1/4 IN minimum stroke thickness.
   4. Engraved metal: Epoxy enamel fill engraved copy.
   5. Engraved plastic laminate: Engrave through exposed plastic laminate face ply to expose contrasting core ply.
   6. Subsurface engraved acrylic sheet:
      a. Back face: Reverse engraved.
      b. Engraved copy: Fill with epoxy enamel.
      c. Opaque background color coating: Apply over epoxy-enamel filled copy.

F. Silkscreened Copy:
   1. Subsurface copy:
      a. Form panel face: Apply copy to back face of clear acrylic sheet to form panel face.
      b. Produce precisely-formed opaque images with smooth edges.
      c. Print copy: Reverse silkscreen process.
         1) Copy shall be over sprayed with opaque background color coating.

G. Raised Copy:
   1. Exterior grade:
      a. Fabrication of raised lettering on metal background to magnesium alloy plate shall be by acid etching process.
   2. Interior Grade, solid core materials:
      a. Manufacturer: Nova Polymers Inc.
      b. Provide solid core materials in thicknesses indicated.
   3. Machine-cut letter forms, and chemically welded to indicated materials.
      a. Form characters with square cut edges free from burrs and cut marks.
      b. Panel material, and raised copy thickness: Not less than 1/32 IN.

H. Metal letters and Numbers:
   1. Comply with requirements indicated for manufacturing process, finish, materials, message content, style, and size.
   2. Metal: Stainless steel, unless otherwise indicated.

I. Fabricated Metal Letters and Numbers:
   1. Fabricate metal letters and numbers in sizes and styles indicated.
      a. Thicknesses: As indicated.
      b. Form exposed faces and sides of characters.
      c. Produce surfaces free from warp and distortion.
      d. Provide internal bracing for stability.
      e. Provide internal bracing for attachment of required mounting accessories.

J. Illuminated Units:
   1. Illuminate units using manufacturer's standard UL approved lighting components.
      a. Lighting components include insulators, neon tubing, transformers and other components.
      b. Provide access for servicing and for concealed connections to building system.
      c. Coordinate electrical connections with Electrical Specification Divisions.

3.3 INSTALLATION

A. General Requirements:
   1. Locate identification devices and accessories where shown, or scheduled in AG-Series drawings.
   2. Use mounting method types indicated and as described, and in accordance with manufacturer's recommendations.
   3. Field determine exact locations and dimensions for identification devices prior to fabrication.
   4. Contractor immediately notify Owner and Architect if building and site conditions are at variance with drawings.
      a. Do not to proceed until the unsatisfactory conditions have been corrected.
   5. Install identification devices in positions shown on drawings.
      a. Install identification devices at heights indicated, plumb, and in alignment.
      b. Brace devices securely until permanent anchorage is made.
      c. Identification device surfaces are to be installed free from distortion or other defects in appearance.
      d. Perform cutting, drilling, and fitting carefully.
      e. When required, fit at site before finishing.

B. General Location Requirements:
   1. Single doors: Install identification device on wall adjacent to latch side of door.
   2. Double doors: Install identification device on nearest adjacent wall.

3. Mount 60 IN above finish floor to centerline of identification device, unless otherwise indicated.
    a. Signs may be mounted so that tactile characters and Braille are located between 48 IN and 60 IN above finish floor.

C. Provide signs at elevator call stations directing use of stairs: See ASME-A17.1, Appendix H.

D. Provide stair identification devices in exit stairs connecting more than 3 stories: Reference International Building Code and NFPA 101.

E. Mount identification devices according to methods specified or as indicated on drawings for each type.

F. Manufacturer to provide printed instructions or drawings on wall blocking locations and type required to Contractor in a timely manner to allow installation.

3.4 CLEAN-UP

A. At completion of the installation, clean identification devices with appropriate cleaning agents prior to final inspection and acceptance. Grease, fingerprints, smudges, adhesive, etc. remaining on identification devices or components will not be acceptable. Protect identification device units from damage until acceptance by Owner.

B. Remove packing and debris from the project site upon completion and leave the site in a condition which is clean and free of damage and abuse.

END OF SECTION

SECTION 10 14 23
SIGNS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services required for fabrication and installation of Signs as indicated in accordance with the Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. 2010 ADA Standards for Accessible Design.

B. American National Standards Institute, ICC/ANSI A117.1.

1.3 SUBMITTALS

A. Samples:
   1. Color and font samples for approval.

1.4 WARRANTY

A. Manufacturer shall warrant workmanship and materials for a period of two (2) years.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

1. Signs:
   a. Base:
      1) ASI Sign Systems.
      2) JP Cooke

2.2 MATERIALS

A. Signs:
   1. Three-ply plastic laminate, 1.5 IN wide x length required for script.
   2. Nominal letter height: 3/4 IN.
   3. Letters and numbers: Raised 1/32 IN.
   4. Upper case.
   5. Letter style: Sans serif.
   6. Color: As selected.
      a. Characters: Dark.
      b. Background: Light.
   7. Finish: Nonglare.
   8. Bevel edges.
   9. Letters shall conform to following proportional standard:
      a. The font width of uppercase letter “O” shall be 55 percent minimum and 110 percent maximum height of uppercase letter “I”.
      b. Stroke thickness of uppercase letter "I" shall be 10 percent minimum and 30 percent maximum height of character.
   10. Tactile lettering shall conform to following standards:
      a. Character height measured vertically from the baseline of character shall be 5/8 IN minimum and 2 IN maximum based on height of uppercase letter “I”.

b. Stroke thickness of uppercase letter "I" shall be 15 percent maximum height of character.
c. The font width of uppercase letter “O” shall be 55 percent minimum and 110 percent maximum height of uppercase letter “I”.
d. Maintain minimum 1/8 IN font separation between characters.

11. Braille characters shall conform to the following standard:
    a. Braille characters shall be separated from adjacent raised characters or symbols 1/2 IN.
    b. Grade 2 Braille translation to be provided by identification device manufacturer.

B. Directional and identification signs for communications systems: International symbols.

C. Adhesive: 3M double-coated urethane foam tape.
    1. 4032 for smooth surfaces.
    2. 4016 for rough surfaces.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Location:
    1. Single doors: Install on wall adjacent to latch side of door.
    2. Double doors: Install on nearest adjacent wall.

B. Mount 5 FT above finish floor to centerline of sign.

C. Mount using adhesive tape.

3.2 SCHEDULE

A. Provide signs as follows:
    1. "Stair" at each floor, each stair.
    2. "Mechanical Room" at each mechanical space door.
    3. "Men" at each men's toilet.
    4. "Women" at each women's toilet.
    5. "Janitor" at each janitors closet.
    6. "Electrical" at each electrical closet.
    7. "Not an Exit": 10 signs.

B. Provide signs at elevator call stations directing use of stairs: See ASME-A17.1, Appendix H.

C. Provide stair identification sign in enclosed stairs connecting three or more stories.
    1. See both IBC and NFPA for features of sign.

D. Provide international accessibility symbols at:
    1. Accessible entrance.
    2. Accessible exit.
    3. Accessible toilets.
    4. At inaccessible elements, provide directional signage to indicate route to nearest accessible element.

E. Provide directional and identification signs for:
    1. Assistance listening systems.

END OF SECTION

SECTION 10 14 43
PHOTOLUMINESCENT EGRESS MARKINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Photoluminescent Egress Markings, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 DESCRIPTION

A. Work specified in this Section includes, but shall not be limited to, a complete photoluminescent exit path marking system consisting of following:
   1. Stair tread markers.
   2. Handrail markers.
   3. Obstacle markers.
   4. Exit path demarcation markers.
   5. Door signage and directional signage, including, but not limited to, emergency exit markers.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Firm engaged in the manufacture of photoluminescent signage of types and sizes required, and whose products have been in satisfactory use in similar service for a minimum of five (5) years.
   2. Manufacturer shall be ISO 9001 certified.
   3. Manufacturer shall be listed with the City of New York, Department of Buildings and products shall have approved Materials and Equipment Acceptance (MEA) numbers.

B. Installer Qualifications:
   1. Installer shall be a firm that shall have a minimum of five (5) years of successful installation experience with projects utilizing photoluminescent signage similar in type and scope to that required for this Project.

C. Single Source Responsibility:
   1. Obtain photoluminescent signage from single source with resources to produce products of consistent quality in appearance and physical properties without delaying work.

D. ASTM International (ASTM):
   1. ASTM B117 Standard Practice for Operating Salt Spray (Fog) Testing Apparatus.
   2. ASTM B221/B221M Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Shapes, and Tubes.
   3. ASTM D635 Standard Test Method for Rate of Burning and/or Extent and Time of Burning of Self-Supporting Plastics in a Horizontal Position.
   4. ASTM D3648 Standard Practices for the Measurement of Radioactivity.
   5. ASTM D4828 Standard Test Methods for Practical Washability of Organic Coatings.
   6. ASTM E162 Standard Test Method for Surface Flammability of Materials Using a Radiant Heat Energy Source.
   7. ASTM E2072 Standard Specification for Photoluminescent (Phosphorescent) Safety Markings.
   8. ASTM G155 Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials.

E. Bombardier:
   1. SMP800-C, Toxic Gas Generation Test.

F. Code of Federal Regulation (CFR):
   1. 28 CFR Part 36, Americans With Disabilities Act - hereinafter referred to as ADA.

G. International Code Council (ICC):
   1. ICC IBC, International Building Code.

H. International Organization for Standardization (ISO):
   1. ISO 7010, Graphical Symbols - Safety Colors and Safety Signs - Safety Signs Used in Workplaces and Public Areas.
   2. ISO 9001, Quality Management Systems - Requirements.
   3. ISO 17398, Safety Colors and Safety Signs - Classification, Performance, and Durability of Safety Signs.

I. National Fire Protection Association (NFPA):
   1. NFPA 170, Standard for Fire Safety and Emergency Symbols.

J. New York City Building Code:
   1. Standard RS 6-1, Photoluminescent Exit Path Markings.
   2. Standard RS 6-1A, Additional Standards as Required by Reference Standard RS 6-1 for Photoluminescent Exit Path Markings.

K. Underwriters Laboratories, Inc. (UL):
   1. UL 1994, Standard for Luminous Egress Path Marking Systems.

1.4 SUBMITTALS

A. Shop Drawings:
   1. Submit shop drawings for each product and accessory required.
   2. Include information not fully detailed in manufacturer’s standard product data, including, but not limited to, complete fabrication details, required anchorage, etc.

B. Product Data:
   1. Submit product data showing material specified for use.
   2. Include sufficient information to determine compliance with Drawings and Specifications, including, but not limited to, installation instructions, catalog cuts, and templates.

C. Samples:
   1. Manufacturer color charts showing full range of colors and finishes.
   2. Where finishes involve normal color variations, include samples showing full range.
   3. Submit three 76mm 3 IN samples of each specified system.

D. Contract Closeout Information:
   1. Test Reports:
      a. Submit product test reports from a qualified independent inspecting and testing agency showing compliance of photoluminescent signage with requirements, based on comprehensive testing of current product formulations within last two years.
      b. Test reports shall show through compliance that photoluminescent performance complies with UL 1994 or ASTM-E2072 as modified by ICC IBC Section 1027.
   2. Certificates:
      a. Submit certification by manufacturer that products supplied comply with local regulations controlling use of volatile organic compounds (VOC's).

1.5 WARRANTY

A. Contractor shall warrant work of this Section to be in accordance with Contract Documents and free from faults and defects in materials and workmanship for a period of five (5) years.
   1. Warranty shall be signed by installer and manufacturer.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Photoluminescent Egress Markings:
   1. Base:
      a. Balco, Inc.
   2. Optional:
      a. Active Safety Corp.
      b. Clarion Safety Systems
      c. ClearPath Signage Systems
      d. EverGlow NA, Inc.
      e. Jessup Manufacturing Co.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 DESIGN AND PERFORMANCE CRITERIA

A. Photoluminescent Exit Path Marking System:
   1. Low level way-finding materials, including, but not limited to, stair tread markers, handrail markers, obstacle markers, exit path demarcation markers, and emergency exit and directional markers.
   2. Minimum brightness, luminance: 30 millicandlelas per square meter after 10 minutes and 5 millicandlelas per square meter after 90 minutes when tested to ASTM E2072 as modified by ICC IBC Section 1024, or pass UL 1994 test standard.
   3. Stair Tread Markers: Photoluminescent strips shall be 1 IN wide and form an integral part of the stair treads and leading edge of landings.
      a. Mechanical fasteners shall be used to anchor stair nosing to the substrate.
      b. Adhesives may be used in conjunction with mechanical fasteners to affix stair nosing to the substrate.
      c. Adhesives may not be used as the sole means for affixing stair nosing to the substrate.
      d. Stair nosing treads shall be abrasive filled or shall have serrated surfaces to improve slip resistance.
      e. Surfaces shall be slip-resistant as defined in ADA recommendations.
      f. Stair nosing treads shall meet OSHA Barrier-Free Code requirements for stair design in public buildings.
   4. Handrail Markers: Photoluminescent handrail markers shall be 1 IN wide; and adhered to the handrail with a factory-applied pressure sensitive adhesive.
   5. Obstacle Markers: Photoluminescent obstacle markers 1 IN wide; with a pattern of 51mm 2 IN photoluminescent strips alternating with 2 IN black bands angled at 45 degrees adhered to obstacles as defined by the established Code.
   6. Exit Path Demarcation Markers: Photoluminescent exit path demarcation markers shall be 1 IN wide; adhered to the floor with a factory-applied pressure sensitive adhesive.
   7. Emergency Exit and Directional Markers: Directional and door signs shall be in compliance with the New York City Building Code Standard RS 6-1 and Standard RS 6-1A.

2.3 MATERIALS

A. General:
   1. Aluminum:
      a. ASTM B221/B221M, Alloy 6063-T5 for extrusions.
   2. Photoluminescent:
      a. Phosphorescent pigment, strontium aluminate oxide, combined with a carrier/fixer that shall be cross-linked to an aluminum substrate at high temperature.
      b. Brightness Rating:
         1) Exceed New York City Building Code Standard RS 6-1 and Standard 6-1A of BR: 30-7-5 when tested in accordance with ISO 17398.

c. Pass:
   1) UL 1994.
   2) ASTM E2072, as modified by ICC IBC Section 1024.
d. UV Degradation:
   1) 2000 hours when tested in accordance with ASTM-G155.
e. Salt Spray Resistance:
   1) ASTM B117.
f. Cleaning Test:
   1) ASTM D4828, pass.
g. Rate of Burning:
   1) ASTM D635, comply.
h. Surface Flammability: ASTM E162.
i. Toxicity Testing: Bombardier SMP800-C.
j. Radioactivity Test: ASTM D3648.
k. Photoluminescent pigment and glow properties shall continue to charge and emit glow with less than a 5 percent loss of light output over a 25 year period.

3. Abrasive:
   a. Two-part epoxy combined with aluminum oxide grit.
4. Labeling:
   a. Products shall exhibit manufacturers name and model number, and MEA number and brightness number for New York City.
5. Fasteners:
   a. As required for complete installation to manufacturer's instructions.
   b. Handrail strip and exit path demarcation strip shall have a factory applied pressure sensitive adhesive backing.
   c. Door and directional signs shall be fastened with materials supplied by manufacturer.

2.4 PHOTOLUMINESCENT EXIT PATH MARKING SYSTEM

A. General:
   1. Viewing Distance: 25 FT.
   2. Activation: 11Lx 1 footcandle of fluorescent illumination.
   3. Non-electric, non-radioactive, no hazardous materials, long life, near-zero maintenance.

B. Photoluminescent Stair Tread Markers:
   1. Dimensions:
      a. Width: 1 IN.
      b. Length: 48 IN.
   2. Profile: Flat.
   3. Base product: IllumiTread Photoluminescent Egress System Stair Nosing by Balco, Inc.

C. Photoluminescent Handrail Markers:
   1. Dimensions:
      a. Width: 1 IN.
      b. Length: 1219mm 48 IN.
   2. Profile: Flat.
   3. Base product: IllumiTread Handrail Illumination Strips, Model No. 4010C by Balco, Inc.

D. Photoluminescent Obstacle Markers:
   1. Dimensions:
      a. Width: 1 IN.
      b. Length: 42 IN.
   2. Profile: Flat.
   3. Base product: IllumiTread Obstacle Markers, Model No. 4211 by Balco, Inc.

E. Photoluminescent Exit Path Demarcation Markers:
   1. Dimensions:
      a. Width: 1 IN.
      b. Length: 42 IN.

2. Base product: IllumiTread Demarcation Way Finding Strips, Model No. 4211C by Balco, Inc.

F. Photoluminescent Emergency Exit and Directional Markers:
1. Comply with NFPA 170 and ISO 7010).
2. Dimensions:
a. Width: 4.5 IN.
b. Length: 4.5 IN.
3. Base product: IllumiTread Directional and Door Signs by Balco, Inc.

2.5 FABRICATION

A. Stair Tread Marker Assemblies:
1. Fabricate as detailed.
2. Provide abrasive treads of specified color.
3. Provide specified anchors and where required, tread plate securing screws.
4. Surfaces to be embedded in concrete shall be coated with a clear acrylic lacquer.
5. Manufacturer shall fill two component stair nosing sub-channels with a protective material to provide protection during construction.
6. Prior to shipment, manufacturer shall cover stair nosing photoluminescent strip and abrasive ribs with protective tape to eliminate concrete infiltration and staining.

B. Fabricate handrail markers, obstacle markers, exit path demarcation markers, and emergency exit and directional markers using phosphorescent pigment, strontium aluminate oxide, combined with carrier/fixer cross-linked to aluminum substrate.

2.6 FINISHES

A. Aluminum Subchannels and Tread Plates:
1. Clear acrylic lacquer coated for components to be embedding in concrete.

B. Slip resistant Surfaces:
1. Abrasive ribs: Black.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verification of Conditions:
1. Examine areas and conditions under which work is to be installed.
2. Notify Contractor in writing, with a copy to Owner and Architect, of any conditions detrimental to proper and timely completion of work.
3. Do not install photoluminescent signage until space is enclosed and weatherproof, wet work in space is completed and nominally dry, work above ceilings is complete, and ambient temperature and humidity conditions are and will be continuously maintained at values near those indicated for final occupancy.
4. Verify installed photoluminescent exit path marking system are exposed to sufficient activating illumination to ensure photoluminescent markers will be charged and meet required brightness rating.
5. Do not proceed with work until unsatisfactory conditions have been corrected.
6. Beginning of work shall indicate acceptance of areas and conditions as satisfactory by Installer.

3.2 INSTALLATION

A. Preparation and installation shall be in accordance with reviewed product data, final shop drawings, manufacturer’s written recommendations, established Code requirements, and as indicated in Drawings.
1. Sub-channels of two component stair nosing shall be installed with concrete pour.
2. Tread plates of two-component stair nosing shall be installed in final stages of construction.

B. Work shall be aligned plumb, level and, where required, flush with adjacent surfaces.

C. Stair tread markers shall be rigidly anchored to substrate.
   1. Install full length of each step and landing edge.

D. Handrail markers shall be adhered to handrails with factory-applied pressure sensitive adhesive.
   1. Placed strips on top surface of handrail for entire length of handrail, including handrail extensions and newel post caps.
   2. At bends or corners, stripe shall be as continuous as practicable with no more than a 102mm 4 IN gap in photoluminescent strip.

E. Obstacle markers shall be adhered to obstruction.
   1. Mark obstacles at or below for 78 IN in height and projecting more than 102mm 4 IN into egress path.

F. Exit path demarcation markers shall be adhered with factory applied pressure sensitive adhesive.
   1. Strips shall be as continuous as practicable with no more than a 4 IN gap in photoluminescent strip.
   2. Floor-Mounted:
      a. Position as close to wall as practicable but no more than 4 IN away from wall.
      b. Extend to within 2 IN of the leading edge nosing
      c. Extend across floor in front of obstacles.
      d. Continue across doors except door frames marked as intermediate and final exit doors.
   3. Wall-Mounted:
      a. Place bottom edge no more than 4 IN above finished floor.
      b. At top and bottom of stairs, exit demarcation lines shall drop vertically to floor within 2 IN of leading edge nosing.
      c. Transition vertically to floor and then extend across floor where a line on floor is only practical method of outlining path.
      d. Continue across doors, or transition to floor and extend across floor in front of door, except doors marked as intermediate exit doors and doors marked as final exit doors.

G. Emergency exit and directional markers shall be located and adhered at a maximum height from the floor of 18 IN.
   1. Intermediate Exit Doors and Final Exit Doors:
      a. Intermediate exit doors are doors that lead from a vertical exit, horizontal extension in a vertical exit, horizontal exit, supplemental vertical exit, or exit passageway, but do not lead directly to exterior or to a street level lobby.
      b. Final exit doors are doors that lead directly to exterior or a street level lobby.
      c. Mount signs on center of door.
      d. Door hardware shall be marked with no less than 16 square inches of photoluminescent material and photoluminescent material shall be located behind, immediately adjacent to, or on door handle, escutcheon, or both.
         1) Panic bars shall have a 1 IN photoluminescent strip along their entire length.
      e. Top and sides of door frames shall be marked with a solid and continuous 1 IN wide photoluminescent strip with factory applied pressure sensitive adhesive.
         1) Install stripe on door frame.

3.3 CLEANING AND ADJUSTING

A. Clean exposed surfaces as recommended by the manufacturer.

B. Units damaged during shipping or construction shall be repaired or replaced at no additional cost to Owner.

3.4 PROTECTION

A. Provide final protection and maintain conditions shall ensure photoluminescent signage be without damage at time of Substantial Completion.

END OF SECTION

SECTION 10 21 14
SOLID POLYMER HDPE TOILET PARTITIONS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Solid Polymer (HDPE) Toilet Partitions, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. NFPA 286 Standard Methods of Fire Tests for Evaluating Contribution of Wall and Ceiling Interior Finish to Room Fire Growth.

B. U.S. Department of Justice ADA Standards for Accessible Design.

C. ICC/ANSI 117.1: Accessible and Usable Buildings and Facilities. International Code Council and American National Standard Institute.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Drawings including room layout, component sizes and dimensions.
   2. Attachment details and coordination with adjacent work.

B. Product Data:
   1. Manufacturers' product data sheets and details for Solid Polymer Toilet Partitions, components and accessories.

C. Samples:
   1. 2 IN x 2 IN sample of each color and finish as noted in Drawing I-001 Interior Notes and Finish Legend.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

1. Solid Polymer (HDPE) Toilet partitions:
   a. Base:
      1) Scranton Products (Santana, Comtec, Capitol).
   b. Optional:
      1) Accurate Partitions
2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MOUNTING CONFIGURATION

A. Floor-mounted / Overhead-braced.

2.3 MATERIALS

A. Solid Polymer Partitions:
   1. Fire resistant high-density polyethylene (HDPE) with consistent color throughout.
   2. Seamless, non-laminated panels, with 1/4 IN eased edges.
   3. Exposed surfaces that exhibit pitting, seam marks, roller marks, stains, discoloration, or other surface imperfections on finished units not acceptable.

4. Minimum Component Thicknesses: 1 IN.
5. Panel Height: 55 IN high.
    a. Mounting Height: 14 IN AFF to bottom of panel; IN AFF to top.
6. Texture: See Sheet I-001.
7. Color: See Sheet I-001.

B. Accessible stalls:
1. Minimum 5 FT wide.
2. Doors:
    a. Swing out.
    b. Clear Opening Width, End-opening: Minimum 32 IN.
3. Comply with local adopted building codes and amendments.

C. Doors:
1. For 32 IN or wider standard stalls: Minimum 26 IN wide.
2. For standard stalls less than 32 IN wide: Minimum 24 IN wide.

D. Pilasters:
1. General:
    a. Galvanized steel or stainless steel anchorage devices.
    b. Adjustable hanger and/or leveling bolts.
    c. Provide shoes at each pilaster.
2. Floor-mounted / Overhead-braced:
    a. Secure pilaster to floor with minimum of 2 lead expansion shields and anchor screws.
    b. Overhead brace:
        1) Continuous anti-grip aluminum tube, minimum 1/8 IN wall thickness, clear anodized.
        2) Install brace at 82 IN AFF.
    c. Securely attach brace into top of each pilaster and to wall.
    d. Coordinate with wall tile that sits at a height of 48” AFF.

E. Urinal Screens:
1. Wall-hung:
    a. Size:
        1) 18 IN x 42 IN.
    b. Same construction and finish as toilet compartments.
    c. Continuous, double-flanged wall bracket.

F. Pilaster shoes:
1. AISI Type 302/304 18-8 stainless steel.
2. 20 GA, 3 IN high.

G. Stirrup brackets:
1. Manufacturer's heavy-duty design for attaching panels to walls and pilasters.
2. Type 302 stainless steel.

H. Operational Hardware:
1. Material/Finish: Chromium plated brass or US32D stainless steel.
2. Slide Latch:
    a. Surface mounted.
    b. ADA compliant.
    c. Emergency Access.
3. Strike:
    a. Wrap around type strike/keeper.
    b. Integral bumper.
4. Door pull:
    a. ADA compliant Door Pull.

I. Bumper coat hook:
   1. Rubber tipped combination bumper and coat hook.
   2. Provide one for each compartment.

J. Hinges:
   1. Self-closing, helical continuous hinges.
   2. Stainless steel.
   3. Tamper-resistant fasteners.

K. Toilet Accessories: See Section 10 28 13.

L. Anchorages and fasteners:
   1. Exposed fasteners: Tamper-resistant, stainless steel or brass, finish to match hardware.
   2. Concealed anchors: Galvanized steel, hot dip coated after fabrication complying with ASTM A385.

2.4 FABRICATION

A. Verify dimensions in field prior to fabrication.

B. Pre-assemble units in shop to greatest extent possible to minimize field cutting and assembly of units.

C. Provide concealed reinforcement for installation of hardware, fittings, brackets, and required accessories.

D. Exposed metal and hardware finishes:
   1. Stainless steel:
      a. ASTM A480, bright polished finish No. 4; or
      b. ANSI/BHMA-A156.18, Code 629; to match US32.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Verify that adequate Wall Backing has been installed.
   1. Metal Wall Backing: Specified in Section 09 22 16.
   2. Coordinate and direct installation at locations required for Toilet Partitions and accessories.

C. Correct unsatisfactory conditions.

D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install in a rigid, straight, plumb and level manner, to indicated lay out.

B. Clearances:
   1. Between pilasters and panels: Maximum 1/2 IN.
   2. Between panels and walls: Maximum 1 IN.
   3. Between doors and pilasters: Maximum 3/16 IN.
   4. Between floor and bottom of panels: 12 IN.

C. Secure to walls with minimum of 2 stirrup brackets near top and bottom of panel.
   1. Locate brackets so holes occur in masonry or tile joints.
   2. Use manufacturer's recommended anchoring devices, as indicated on shop drawings.

D. Floor-mounted / Overhead-braced partitions:
   1. Secure pilasters to floor.
   2. Level, plumb, and tighten.

3. Secure overhead brace with minimum of two fasteners per pilaster.
4. Set tops of closed doors parallel with overhead brace.

E. Urinal Screens:
1. Provide wall channels, wall plates and studs as recommended by manufacturer to suit wall construction.
2. Set units in accordance with manufacturer's instructions to support units and resist impact.

3.3 ADJUST AND CLEAN

A. Adjust and lubricate hardware for proper operation after installation.
1. Set hinges on in-swing doors to hold unlatched doors open approximately 30 degrees.
2. Set hinges on out-swing doors to return to fully closed position.

B. Replace damaged work as directed.

C. Perform final adjustments just prior to final inspection.

D. Clean exposed surfaces, hardware, fittings and accessories and touch up minor scratches and other imperfections using materials and methods recommended by manufacturer.

3.4 SCHEDULE OF SOLID POLYMER HPDE TOILET PARTITIONS

A. Install Solid Polymer HDPE Toilet Partitions in the following rooms:

Schedule of Solid Polymer HDPE Toilet Partitions	
Room Name	Room Number
Female Tlt	231
Male Tlt	232
Female Tlt	246
Male Tlt	247

END OF SECTION

SECTION 10 26 00
WALL PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Wall Protection Specialties, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Single Source Responsibility:
   1. Provide components of the wall protection system manufactured by same company to ensure compatibility of color, texture and physical properties.

B. ASTM International (ASTM):
   1. ASTM B221 Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes
   2. ASTM D1308 Standard Test Method for Effect of Household Chemicals on Clear and Pigmented Organic Finishes
   3. ASTM E84 Standard Test Method for Surface Burning Characteristics of Building Materials

C. American Architectural Manufacturers Association (AAMA):
   1. AAMA 611 Voluntary Specification for Anodized Architectural Aluminum

1.3 SUBMITTALS

A. Shop Drawings:
   1. Show locations, extent and installation details of handrails, crashrails, wall guard and corner guards.
   2. Show methods of attachment to adjoining construction.

B. Product Data:
   1. Manufacturer’s standard literature indicating systems and products specified.

C. Samples:
   1. Material samples of each color and texture listed for wall protection as noted in Drawing I-001 Interior Notes and Finish Legend.

D. Contract Closeout Information:
   1. Maintenance data.
   2. Interior finish fire performance data for each item and type specified:
      a. Manufacturer's printed information including:
         1) Fire class.
         2) NFPA test number.
         3) Photograph.
         4) Proof of purchase.
         5) See Section 01 78 26.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wall Protection Specialties:
   1. Base:
      a. Construction Specialties
   2. Optional:
      a. InPro

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. The following general material requirements apply to polyester resin wall protection devices.
   1. Cover Material:
      a. High-impact, rigid polyester resin, homogeneous color throughout entire thickness, free of embedded foreign material, and having a blemish free surface.
   2. Retainer assemblies:
      a. Class II anodized 6063-T6 aluminum.
   3. Pre-fabricated, color-matched end caps
      a. Rigid polyester resin.
      b. Mechanically secured with concealed fasteners.
   4. Prefabricated gasket with aluminum sub-base.
   5. Fasteners:
      a. Non-corrosive and compatible with aluminum retainers and wall construction.
   6. Resistant to alkali, chemicals, cleaning agents and light.
   7. Color match wall protection components.
   8. Fire performance characteristics:
      a. UL-listed, Class A
      b. Flame Spread Index: Less than 25.
      c. Smoke Developed: Less than 450.

2.3 2-PIECE CORNER GUARDS (CG)

A. 0.078 IN thick, high-impact, rigid polyester material with end caps.

B. Continuous extruded aluminum retainers.

C. Impact resistance: 18 LB/IN width.

D. Furnish custom angled units where corners are less or greater than 90 degrees.

E. At terminal end of walls less than 8 IN thick, use 2 IN x 2 IN corner guards with wall guard sheet of same height between cornerguards.

F. Surface-mounted Polyester Resin Corner Guards:
   1. SM-20N by Construction Specialties.
   2. Size: 2 IN x 2 IN.
   3. Nose Radius: 1/4 IN.
   4. CG-1 Overall Height – Partial height, top of wall base to top of corner guard: 48 IN.
   5. Color, Pattern and Texture:
      a. As noted in Drawing I-001 Interior Notes & Finish Legend.

2.4 WALL GUARD (WG)

A. Wall Guard (WG) sheets and accessories:
   1. Acrovyn Rigid Sheet Wallcovering by Construction Specialties.
   2. High-impact, polyester resin.

3. Sheet Thickness: 0.040 IN.
4. Color, Pattern and Texture:
   a. As noted in Drawing I-001 Interior Notes & Finish Legend.
5. Include appropriate primers, adhesives, and sealants.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify walls are in proper condition to receive installation of protection items.

B. Correct unsatisfactory conditions.

C. Coordinate installation of backing required for wall protection specialties scheduled.

D. Commencement of installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install in accordance with manufacturer's recommendations.

B. Install with fasteners suitable for wall substrates encountered, and provide adequate anchoring for anticipated impact loads.

C. Install items where indicated.

3.3 INSTALLATION - CORNER GUARDS

A. 2-piece Corner Guards (CG) – Surface-mounted type:
   1. Unless otherwise indicated: Align bottom edge of corner guards with top of wall base.
   2. Fasten retainers to corners.
   3. Mount caps so they overlap retainers.
   4. Snap covers into place.
   5. Install endcaps.

3.4 INSTALLATION - WALL GUARD (WG)

A. Prepare substrates as required to receive Wall Guard.

B. Install in accordance with manufacturer's recommendations.

C. Where items mounted in wall are surrounded by Wall Guard, trim wall guard to fit behind flanges and cover plates.

D. Where items mounted in wall are partially surrounded by Wall Guard, trim wall guard to abut edges of flanges and cover plates.

E. Preparation – WG over New Gypsum Wallboard:
   1. Ensure new drywall has been taped and sanded smooth.
   2. Wipe clean to remove dust.

F. Wainscot partial-height installations where indicated:
   1. Start bottom edge at floor line and install prior to installation of Wall Base.
      a. Install Wall Base over Wall Guard.
   2. Install sheets horizontally to top of wainscot height and terminate with matching color sealant along top edge of panels.
   3. Top of Wainscot Height:
      a. 48 IN AFF (unless otherwise indicated).
   4. Install wall guard with matching color sealant along top edge of panels.
   5. Vertical Joints:
      a. Install wall guard with butted joints and matching colored sealant at vertical wall joints and inside corners.

b. Joint width: 1/16 IN.
c. Install 2-piece Corner Guard, CG-1, at outside corners. Match wainscot height.

G. Sealant:
1. See Section 07 92 16.
2. Seal to adjacent finish materials including top edge, lateral edges and bottom edge.

3.5 ADJUSTING AND CLEANING

A. Adjust installed end caps as necessary to ensure tight seams.

B. Remove and replace defective, misaligned or damaged units.

C. Verify wall protection items are plumb and rigidly secured to substrate; make adjustments required.

D. Remove protective films.

E. Clean items adjacent areas, using materials and methods recommended by manufacturer.

3.6 PROTECTION

A. Protect installed materials to prevent damage by other trades.

END OF SECTION

SECTION 10 28 13
TOILET AND BATH ACCESSORIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Toilet and Bath Accessories in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Product Data:
   1. Manufacturer's standard literature indicating systems and products specified.

B. Contract Closeout Information:
   1. Maintenance data.
      a. See Section 01 78 23.
   2. Letter stating that extra material has been delivered.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Toilet and Bath Accessories:
   1. Base:
      a. American Specialties, Inc. (ASI)
      b. As noted for specific items.
   2. Optional:
      a. Bobrick Washroom Equipment.
      b. Bradley.

B. Undersink Protectives:
   1. Base:
      a. Truebro, Inc.
   2. Optional:
      a. McGuire.

C. Other manufacturers of a complete line of stainless steel accessories desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
   1. Provide accessories from one manufacturer as far as practicable.
   2. Coordinate and direct installation of backing where required for toilet accessories.
      a. Utilize proprietary backing devices where available.
      b. At remaining locations, provide metal backing per Section 09 22 16.
   3. Provide corrosion resistant fasteners and attachment devices, and other fittings necessary to assure function and operation of accessories.

B. Stainless steel, unless noted otherwise.
   1. Type 304, 18-8 per ASTM A240/A240M.
   2. Finish: Satin #4 on exposed surfaces.

C. See drawings for items, quantities, and locations required.

D. Locks:
   1. Tumbler locks keyed alike.

2.3 TOILET ACCESSORIES

A. Hooks:
   1. TA1A:
      a. Single Robe Hook.
      b. Model K-14458-BN by Kohler.
      c. Mount oneTA1A at 66 IN AFF.
      d. Mount one TA1A at 48 IN AFF.

B. Toilet Tissue Dispensers:
   1. TA2:
      a. Double Roll Tissue Dispenser.
      b. Cast aluminum with ABS thermoplastic spindle.
      c. Provided by Owner.
      d. Non-controlled delivery.

C. Feminine Napkin/ Tampon Dispenser:
   1. TA4:
      a. Model 0464-25 by ASI.
      b. 25 cent operation.
      c. Semi-recessed.

D. Feminine Napkin Disposal:
   1. TA5:
      a. Model 0852 by ASI.
      b. Surface mounted.

E. Paper Towel Dispensers:
   1. TA7:
      a. Provided by Owner.
      b. Surface mounted.
      c. Capacity: 400 C-fold or 525 multi-fold towels.

F. Waste Receptacles:
   1. TA8:
      a. Model 0828 by ASI.
      b. Surface mounted.

G. Soap Dispensers:
   1. TA9V:
      a. Provided by Owner.
      b. All-purpose valve.
      c. Surface mounted.

H. Mop Broom Rack:
   1. TA10:
      a. Model 8215-3 by ASI.
      b. Three rubber cam mop holders
      c. Surface mounted.
   2. TA10A:
      a. Model 1315-4 by ASI.
      b. Four rubber cam mop holders and three stainless steel hooks.
      c. Stainless steel shelf and drying rod.
      d. Surface mounted.

I. Mirrors:
   1. TA13:
      a. Model 0600 by ASI.
      b. Polished stainless steel framed mirror.
      c. 18 IN wide x 36 IN high.

J. Undersink Protectives:
   1. TA29
      a. Lav Guard 2 by Truebro
      b. Rigid vinyl pipe wraps conforming to the piping configurations encountered.
      c. Stain-resistant, rigid, impact-resistant and paintable.
      d. Minimum thermal conductivity at mean temperature: k ≤ 1.17 @75 DegF.
      e. Attachment method: Reusable snap clips or seamless pre-wrapped.
      f. Color: White.
      g. Provide where indicated at accessible wall-hung lavatory sinks.

K. Grab Bars:
   1. General:
      a. Base Products: 3800 Series by American Specialties.
      b. Bar Diameter: 1-1/2 IN OD.
      c. Concealed mounting.
      d. Provide anchoring devices to withstand minimum concentrated load of 250 LB and 1000 LB at bariatric locations.
      e. Include 3800M spacer to keep grab bar parallel to wall faces at offset conditions.
   2. TA33V:
      a. 18 IN vertical grab bar.
   3. TA36:
      a. 36 IN horizontal grab bar.
   4. TA37:
      a. 42 IN horizontal grab bar.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Verify that adequate wall backing has been installed.
   1. Coordinate and direct installation backing where required for toilet accessories.
   2. Utilize proprietary backing devices where available.
   3. At remaining locations, provide metal backing per Section 09 22 16.

C. Correct deficiencies before proceeding to install accessories.

D. Where item is mounted on or in a toilet partition, coordinate interior reinforcing location with partition manufacturer.

E. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions.
   1. Install plumb, level, and rigidly anchored to substrates.

B. Where drawings or schedule require barrier-free accessibility, install accessories in accordance with applicable regulations.

C. Coordinate accessory locations to fit spaces.

D. Coordinate items to avoid mounting conflicts.

E. Mount items with theft-resistant fasteners.

F. Seal grab bar mounting plate to shower walls with silicone sealant or gasket prior to installation of bar.

3.3 ADJUSTING AND CLEANING

A. Protect accessories from damage due to construction.
   1. Remove protective coverings when no longer required.

B. Test accessories and adjust for proper operation.

C. Clean exposed surfaces.

END OF SECTION

SECTION 10 44 00
FIRE PROTECTION SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Fire Protection Specialties in accord with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Provide fire extinguishers, cabinets and accessories by single manufacturer.

B. National Fire Protection Association (NFPA):
   1. NFPA 10 Standard for Portable Fire Extinguishers.

C. Americans with Disabilities Act (ADA):
   1. Standards for Accessible Design.

1.3 SUBMITTALS

A. Contract Closeout Information:
   1. Maintenance data.
      a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fire Protection Specialties:
   1. Base:
      a. JL Industries.
   2. Optional:
      a. Badger.
      b. Larsen's Manufacturing.
      c. Nystrom.

B. Fire Extinguishers:
   1. Base:
      a. JL Industries.
   2. Optional:
      a. Amerex.
      b. Badger.
      c. Larsen's Manufacturing.
      d. Nystrom.
   3. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 FIRE EXTINGUISHER (FE)

A. Multi-Purpose Chemical Fire Extinguishers:
   1. Typical FE, except where more specialized types are required.
   2. Fluidized and siliconized chemical powder extinguishing agent suitable for classes A, B and C fires.
   3. Construction:
      a. Heavy-duty steel cylinder with metal valve and siphon tube with replaceable molded valve stem seal, visual pressure gauge, pull pin and upright squeeze grip.

b. Corrosion and impact-resistant, powder coat finish.
c. Color: Red, in accord with OSHA requirements.

4. Capacity: 10 LBS.
   a. UL-rating: 4A-80BC.
   b. Base Product Model: Cosmic 10E by JL Industries.
5. Provide one FE for each:
   a. Fire Extinguisher Cabinet (FEC).
   b. Fire Extinguisher (FE) location.
   c. Fire Valve Cabinet (FVC).

2.3 FIRE EXTINGUISHER CABINETS (FEC)

A. General:
1. Provide FIRE EXTINGUISHER decal for each cabinet. Orient letters vertically.
2. Provide standard fixed door pull at each cabinet.
3. Provide recessed door pulls at each cabinet.
4. Keys to Door Locks: Three per lock.

B. FEC-1: Semi-recessed, Steel, Fire Extinguisher Cabinet:
1. Cold rolled steel tub with 1-1/2 IN square edge steel trim style and door.
   a. Fire-rated Cabinets: Provide fire-rated cabinets where FEC-1 is indicated to be installed in fire-rated walls.
   b. Maximum projection from wall surface: 1-1/2 IN.
2. Cabinet Construction:
   a. Non-fire rated Cabinets: Single-wall, 0.026 IN (26 GA) steel.
   b. Fire Rated Cabinets: Double-wall construction fabricated from 0.043 IN (18 GA) steel lined with minimum 5/8 IN thick, fire-barrier material.
3. Finish: Powder coated.
   a. Color: White.
4. Tub Size, inside clear (WxHxD): 10-1/2 x 24 x 6 IN.
5. Door Style: Vertical strip Glazing; Clear acrylic.
6. Lock: Cam lock with emergency break-away release mechanism.
   a. Base Product: Saf-T-Lok by JL Industries.
7. Base Product: Ambassador Series 1016 and Ambassador FX series by JL Industries.

2.4 WALL BRACKETS

A. Wall Brackets:
1. Manufacturer's standard steel, designed to secure fire extinguisher to wall or structure, of sizes required for types and capacities of fire extinguishers indicated
2. Finish: Baked-enamel or powder coat.
3. Include mounting accessories suitable for substrate wall type.
4. Locations: Install wall brackets for each fire extinguisher (FE) not indicated to be installed in a cabinet.

2.5 MISCELLANEOUS ITEMS (SPECIFIED ELSEWHERE)

1. Specified in Section 21 10 00 and shown on Mechanical Drawings where required.

2.6 FABRICATION

A. Cabinets:
1. Weld joints and grind smooth.
2. Provide factory-drilled mounting holes.
3. Install door locks at factory.

B. Cabinet Doors:
1. Fabricate doors according to manufacturer's standards, from materials indicated and coordinated with cabinet types and trim styles selected.
2. Fabricate door frames with tubular stiles and rails and hollow-metal design, 1/2 IN thick.

C. Cabinet Trim:
   1. Fabricate cabinet trim in one piece with corners mitered, welded, and ground smooth.

2.7 FINISHES

A. Comply with NAAMM's Metal Finishes Manual for Architectural and Metal Products.

B. Protect mechanical finishes on exposed surfaces of fire protection cabinets from damage by applying a strippable, temporary protective covering before shipping.

C. Finish fire protection cabinets after assembly.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrates to accept installation.

B. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Install extinguishers and cabinets within limitations of NFPA-10 and ADA.

B. Securely fasten mounting brackets and cabinets to structure, square and plumb, to comply with manufacturer’s instructions.

C. Provide unistrut or welded steel support where needed to mount cabinets or brackets in mechanical rooms and similar locations.

D. Provide required closures.

E. Installation Heights:
   1. Fire Extinguisher Cabinets (FEC):
      a. Locate with centerline of cabinet door handle not more than 48 IN AFF.
   2. Fire Extinguishers (FE) not contained in a cabinet:
      a. Locate wall brackets such that extinguisher release mechanism will not be higher 48 IN AFF.

3.3 ADJUSTING AND CLEANING

A. Remove temporary protective coverings and strippable films.

B. Adjust fire protection cabinet doors to operate easily without binding.
   1. Verify that integral locking devices operate properly.

C. Clean interior and exterior surfaces.

END OF SECTION

SECTION 10 51 13
METAL LOCKERS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and General Provisions of the Contract, including General and Supplementary Conditions and Division 1 Specification Sections apply to this Section.

1.2 SUMMARY

A. This Section includes single and multi-tier wardrobe lockers, evidence pass-through lockers of various sizes.

B. Related Sections include the following:
   1. Division 4, Section “Unit Masonry” for masonry bases.
   2. Division 6, Section “Miscellaneous Carpentry’ for wood furring and grounds.

C. Submittals: Submit the following in accordance with Contract Conditions and Division 1 Specification Requirements:
   1. Product Data: Include construction details, materials descriptions, dimensions of individual components and profiles, and finishes for each type of locker and bench.
   2. Shop Drawings: Include plans, elevations, sections, details, attachments to other Work, and locker numbering sequence.
   3. Samples: Manufacturer’s color charts showing the full range of colors available for units with factory applied color finishes.
   4. Samples for Verification: For lockers and locker benches, in manufacturer’s standard sizes, showing the full range of color, texture, and pattern variations expected. Prepare Samples from the same material to be used for the Work.
   5. Maintenance Data: For adjusting, repairing, and replacing locker doors and latching mechanisms to include in maintenance manuals specified in Division 1.

D. Source Limitations: Obtain each type of locker unit and accessories through one source from a single manufacturer. Obtain all lockers in a room through one source from a single manufacturer.

E. Delivery, Storage, and Handling: Do not deliver lockers until spaces to receive them are clean, dry, and ready for locker installation.
   1. Protect lockers from damage during delivery, handling, storage, and installation.
   2. Deliver master keys, control keys, and combination control charts to Owner.

F. Coordinate size and location of bases.

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:
   1. American Locker Security Systems, Inc.
   2. DeBourgh Manufacturing Co.
   3. Interior/Medart.
   4. Lyon Metal Products, Inc.
   5. Tiffin Metal Products, Tiffin, Ohio

B. Wardrobe Lockers: Fabricate lockers as follows:
   1. Size: 24 inches wide by 24 inches deep by 60 inches high.

2. Body: Form backs, tops, bottoms, sides, and intermediate partitions from steel sheet: flanged for double thickness at back vertical corners. Comply with the following:
   a. Side-Material Sheet Thickness: 0.0359 inch.
   b. Back-Material Sheet Thickness: 0.0359 inch.
   c. Exposed Ends: Form exposed ends of non-recessed lockers from minimum 0.0598 inch thick steel sheet.
3. Frames: Form channel frames from minimum 0.0598 inch thick steel sheet. Form continuous integral door strike on vertical frame members, with latch hooks welded or riveted to door frames. Provide resilient bumpers to cushion door closing.
4. Doors: One-piece steel sheet formed into channel shape at vertical edges and flanged at right angles at top and bottom edges. Fabricate to prevent springing when opening, closing, and to swing 180 degrees. Comply with the following:
   a. Sheet Thickness: 0.0747 inch minimum.
   b. Reinforcing and Sound-Dampening Panels: Brace or reinforce inner face of doors with manufacturer's standard reinforcing angles, channels, or stiffener panels.
   c. Vents: Manufacturer's standards arrangement of perforated or stamped, vents in door face.
5. Shelves: Provide two hat shelves in single tier units; fabricated from minimum 0.0239 inch thick formed steel sheet; flanged on all edges.
6. Hinges: Steel, full loop, five or seven knuckle; tight pin; minimum 2 inches high. Weld to inside of door frame and attach to door with factory-installed, tamper-resistant fasteners.
   a. Provide at least three hinges per door.
7. Recessed Handle and Latch: Manufacturer's standard nickel-plated steel of stainless steel housing, with integral door pull, recessed for latch lifter and locking devices; non-protruding latch lifter; and automatic, pre-locking, pry-resistant latch, as follows:
   a. Provide minimum three-point latching for each door.
   b. Provide combination locks for each locker.

C. Locker Accessories: Provide the following accessories, finished to match lockers, unless otherwise indicated:
1. Interior Equipment: Furnish each wardrobe locker with manufacturer's standard zinc-plated, ball-pointed, double-prong steel hooks. Provide manufacturer's standard galvanized steel rod in lieu of ceiling hook for lockers 18 inches deep or greater.
2. Number Plates: Manufacturer's standard aluminum number plates. Number lockers in sequence indicated. Attach plates to each locker door with rivets.
3. Recess Trim: Manufacturer's standard; fabricated from minimum 0.0478 inch thick steel sheet, minimum 2 ½" inch face width.
4. Filler Panels: Manufacturer's standard; fabricated from minimum 0.0478 inch thick steel sheet in an unequal leg angle shape.
5. Finished End Panels: Manufacturer's standard; fabricated from minimum 0.0239 inch thick steel sheet.

D. Fabrication: Fabricate each locker with an individual door and frame; individual top, bottom, back, and shelves; and common intermediate uprights separating compartments.
1. All-Welded Construction: Preassemble lockers by welding all joints, seams, and connections, with no bolts, screws, or rivets used in assembly.
2. Fabricate lockers square, rigid, and without warp, with metal faces flat and free of dents or distortion. Weld frame members together to form a rigid, one-piece assembly. Form locker body panels, doors, shelves and accessories from one-piece steel sheet.

E. Finish all steel surfaces and accessories, except prefinished stainless steel and chrome-plated surfaces.
1. Baked-Enamel Finish: Immediately after cleaning and pretreating, apply manufacturer's standard baked enamel finish consisting of a thermosetting topcoat; with a minimum dry film thickness of 1.4 mils on doors, frames, and legs, and 1.1 mils elsewhere.
2. Color: As selected by Architect from full range of manufacturer's standard selections.

F. Drawer Unit:
   1. Located under locker unit.
   2. Width to match locker x 36 inches deep x 18 inches high.
   3. 200 pound capacity drawer guides.
   4. Integrally formed ventilated handles.
   5. Keyless lock: locks when locker door is closed. Released by pull handle inside locker.

G. Body Armor Drying Rack: Perforated steel.

H. Bench: Hardwood, attached to top of drawer unit at each locker.

I. Locks: Fabricate lockers to receive manufacturer's standard locking devices, installed on lockers using security-type fasteners:
   1. Built-in Combination Locks: Key-controlled, three number dialing combination locks; combination changes made automatically with a control key.
      a. Bolt Operation: Automatically locking spring bolt.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install metal lockers and accessories level, plumb, rigid, and flush according to manufacturer's written instructions.

B. Connect groups of all-welded lockers together with standard fasteners, with no exposed fasteners on face frames.

C. Anchor lockers to floors and walls at intervals recommended by manufacturer, but not more than 36 inches o.c.

D. Attach finished end panels with fasteners only at perimeter to conceal exposed ends of non-recessed lockers.

END OF SECTION

DIVISION 11

EQUIPMENT

SECTION 11 14 43
SECURITY SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Security Specialties in accordance with provisions of Contract Documents.

B. This Section includes the following:
   1. Security window at 6th floor Control Room.
   2. Bullet-resistant fiberglass sheet.
   3. Bullet-resistant pass box.

C. Related Sections include the following:
   1. Glass for security window: Section 08 88 53 Security Glazing.

D. Completely coordinate with the work of other trades

1.2 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, dimensions of individual components and profiles, and finishes.

B. Shop Drawings: Show fabrication and installation details for security specialties. Include plans, elevations, sections, details, and attachments to other Work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. As indicated for each individual item.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 SECURITY WINDOW

A. Provide transaction window assembly with integral frame and deal tray. Unit shall provide for two-way natural voice communication. Frame shall be 16 gauge stainless steel with #4 brushed finish.
   1. Transaction window shall be Armortex Model SSTW-19. Glaze with security glass type BR-1, as defined in specification Section 08 8853 Security Glazing.

2.3 BULLET RESISTANT FIBERGLASS SHEET

A. Sheet shall be made from multiple layers of starch-oil woven roving ballistic grade fiberglass cloth impregnated with a thermoset polyester resin and compressed into flat rigid sheets. Production technique and materials shall provide controlled internal delamination to permit the capture of a penetrating projectile.

B. Ballistic level:
   1. Bullet Resistant fiberglass composite panels must be **UL Listed** rated for UL 752 Ballistic Level UL 3 (SPSA).

C. Acceptable Product: Armortex Bullet Resistant Fiberglass Armor.

2.4 BULLET RESISTANT PASS BOX

A. Unit shall be constructed of 12 gauge prime painted steel UL Listed non-ricochet bullet resistant fiberglass in the pass box doors. Provide door interlocking mechanism, automatic door closer on the threat side door, threat side door lockout controlled from safe side, key locking safe side door, and installation flanges. Threat side door lock release handle shall be located inside the pass box on the safe side.

B. Acceptable Product: Armortex Bullet Resistant Package Receiver Model SSPR-1818.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions for compliance with manufacturer's requirements for installation.

3.2 INSTALLATION

A. Install security specialties in accordance with manufacturer's recommendations.

END OF SECTION

SECTION 11 19 00
DETENTION EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Detention Equipment in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 DESCRIPTION OF WORK

A. Work of this Section includes, but is not necessarily limited to the following.
   1. Detention and Security locks and hardware.
   2. Finish hardware for detention and security doors.

B. Single Responsibility: Assign the work of this section and the work of the following sections as the single responsibility of a qualified Detention equipment Subcontractor (DES).
   1. 08 34 63 Detention Hollow Metal.
   2. 28 46 19 Electronic Security System

1.3 REFERENCES

A. American Standard Testing Materials (ASTM):
   1. ASTM F1577-95b: Standard Test Methods for S=Detention Locks.
   2. ASTM F 1758-96: Standard Test Methods for Detention Hinges.

B. American Welding Society
   1. D1.1-92: Structural Welding Code –Steel.
   2. D1.3-89: Structural Welding Code –Sheet Steel.
   3. B2.1-84: Welding, Procedures and Performance Qualifications.

C. Builders Hardware Manufacturers Association (BHMA):
   1. ANSI/BHMA A156.1: Butts & Hinges.
   2. ANSI/BHMA A156.4: Door Controls / Closers.
   3. ANSI/BHMA A156.5: Auxiliary Locks & Associated Products.
   4. ANSI/BHMA A156.6: Architectural Door Trim.
   5. ANSI/BHMA A156.8: Door Controls/Overhead Holders.
   6. ANSI/BHMA A156.13: Mortise Locks & Latches.
   7. ANSI/BHMA A156.16: Auxiliary Hardware.
   8. ANSI/BHMA A156.18: Materials and Finishes.
   9. ANSI/BHMA A156.21: Thresholds.
   10. ANSI/BHMA A156.22: Door Gasket Systems.
   11. ANSI/BHMA A156.24 – 2012: Delayed Egress Locks
   12. ANSI/BHMA A156.25 - 2007: Electrified Locking Devices.
   13. ANSI/BHMA A156.28 - 2007: Keying Systems
   14. ANSI/BHMA A156.29 - 2007: Exit Locks, Exit Alarms.
   15. ANSI/BHMA A156.30 - 2003: High Security Cylinders
   16. ANSI/BHMA A156.36 - 2010: Auxiliary Locks

D. International Code Council (ICC)
   1. ICC/ANSI A117-1: Accessible and Usable Buildings and facilities.

E. American Standard Testing Materials (ASTM):
   1. ASTM F1577-05: Standard Test Methods for Detention Locks For Swinging Doors.
   2. ASTM F-1758-05 (2012): Test Methods for Detention Hinges Used on Detention Grade swinging Doors.

F. American Welding Society (AWS):
   1. D1.1-92: Structural Welding Code - Steel.
   2. D1.3-89: Structural Welding Code - Sheet Steel.
   3. B2.1-84: Welding, Procedures and Performance Qualifications.

G. Door and Hardware Institute (DHI).
   1. Recommended Procedure for Processing Hardware Schedules and Templates.
   2. Architectural Hardware Scheduling Sequence and Scheduling Format.
   3. Keying procedures, Systems, and Nomenclature.
   4. Recommended Locations for Builders Hardware for Custom Steel Doors and frames.
   5. Installation Guide for doors and hardware.

H. National Association Architectural Metal Manufacturers (NAAMM)
   1. ANSI/NAAMM HMMA 863-04: Guide Specifications for Detention Security Hollow Metal Doors and Frames:
   2. ANSI/NAAMM HMMA 831=11: Hardware Locations

I. National Fire Protection Association (NFPA)
   1. ANSI/ NFPA 70-2008: National Electrical Code (NEC).
   2. ANSI/NFPA 80-2013: Fire Doors and Fire Windows.
   3. ANSI/ NFPA 101-2012: Life Safety Code:

J. Underwriters Laboratories, Inc. (UL).
   1. UL10C-2009 Fire Tests of Door Assemblies
   2. UL1034:- 00: Burglary Resistant Electric locking Mechanisms.
   3. UL437 - 00: Standard for High Security Key Cylinders.

1.4 SYSTEM DESCRIPTION

A. It is the intent of this specification that detention work including materials and installation be performed by a single, qualified DES acceptable to the Owner and the Architect.

B. Integrate the work of this section with other sections to ensure that components specified in this section complement and work as a system with components specified in related sections.

C. Use products and components designed specifically for detention use unless otherwise specified or approved by the Architect.

D. Performance requirements:
   1. Coordinate installation of electrified items with electrical contractor and ESSS.
   2. Integrate the work of this section with other sections to ensure that components provided under this section complement and work as a system with components provided under related sections.

E. Abbreviations used for manufacturers:

ABH	Architectural Builders Hardware, Itasca, IL
ASSA	Assa, Inc.
Brookfield	Brookfield Industries, Brookfield, MA
Chief	Chief Industries, Grand Island, NE
Derby	Derby Industries, South Bend, IN
DDS	Detention Device Systems, Hayward, CA
Detex	Detec Corp., New Braunfels, TX
Dorma	Dorma, Reading, PA
FA	Folger Adam Products from Southern/Folger Detention Co., San Antonio, TX
GJ	Glynn Johnson, Indianapolis, In
Hager	Hager Hinge Co., St. Louis, MO
Ives	Ives, Indianapolis, IN
LCN	LCN Closers, Princeton, IL
KLN	KLN Steel Products Co., San Antonio, TX

MBS	Marshall Best Security, Indianapolis, IN
MDS	Midwest Detention Systems, Channahon, IL
NG	National Guard, Memphis, TN
Norton	Norton Closers, Charlotte, NC
Norix	Norix Group, Inc., West Chicago, IL
Pemko	Pemko Manufacturing
PHC	Portland Hardware Co., Channahon, IL
Rockwood	Rockwood Manufacturing Co., Rockwood, PA
Sargent	Sargent Lock Co., New Haven, CT
Securitech	Securitech Group, Inc., Maspeth, NY
Southern	Southern Steel Products from Southern/Folger Detention Co., San Antonio, TX
Trimco	Triangle Brass Manufacturing Co., Inc., Los Angeles, CA
Zero	Zero International, Bronx, NY

1.5 SUBMITTALS

A. Product Data.
   1. Furnish manufacturers data sheets.
      a. Include manufacturers specifications and instructions for installation and maintenance.
      b. Include information necessary to show compliance with the specifications.
         1) Highlight items that show compliance with the specification.
   2. Place each set in a heavy duty 3-ring binder and in the same order as specified.

B. Shop drawings.
   1. Furnish detailed drawings of equipment showing construction methods, type and gauge of metal, hardware and fittings.
      a. Include plan, elevations, and cross section details.
      b. Include dimensions, configurations, and connections of detention equipment and its relationship to other work.
   2. Check shop drawings to confirm that adequate provisions have been made for installation of detention equipment.
   3. Furnish setting drawings and templates for anchoring items to be embedded in concrete or masonry.

C. Wiring Diagrams:
   1. Furnish wiring diagrams for electrified hardware and controls.
      a. Include lock functions, monitoring requirements, color coded conductor locations, and conductor connections.

D. Detention Hardware Schedule:
   1. Furnish schedule of detention hardware. Follow the “Recommended Procedure for Processing Hardware Schedules and Templates” published by DHI.
   2. Prepare schedule in vertical format following the “Architectural Hardware Scheduling Sequence and Scheduling Format”, published by DHI.
   3. Coordinate hardware with doors, frames, and related work to ensure proper size, thickness, hand, function and finish of hardware.
   4. Organize schedule into hardware sets indicating designations of items required for each door opening, Include:
      a. Type. Style, function, size and finish of every item.
      b. Name and manufacturer of every item.
      c. Fasteners required for every item.
      d. Location where hardware set is to be used. Cross reference to door numbers in door and frame schedule.
      e. Explanation of abbreviations, symbols, and codes.
      f. Mounting locations.
      g. Door and frame sizes and materials.

5. Include a statement signed and sealed by an AHC (See definition) certifying that the AHC has reviewed the schedule and that, in their opinion, the hardware and services listed in the schedule conform to the requirements of the contract documents.
6. Place each set in a heavy duty 3-ring binder.
7. Submit hardware schedule within 10 working days after award of contract unless otherwise acceptable to the Architect.

E. Samples:
1. Unless otherwise instructed by the Architect, submit a sample of every type of exposed detention hardware, finished as specified and tagged with full description. Submit samples prior to submitting the final hardware schedule.
2. Samples will be reviewed for design, color, and finish.
3. Samples, which are acceptable and remain undamaged through the submittal review, and field comparison process, may be used in the work.

F. Keying schedule.
1. Coordinate keying with the Architect and the Owner.
   a. Prepare a proposed keying schedule for consideration by the Owner.
   b. Meet with the Owner to present and explain the proposed key system.
      1) Review requirements for single wing or double wing escutcheons on lever tumbler locks.
   c. Make modifications and revisions requested by the Owner. Submit a revised schedule.
   d. After final acceptance by the Owner, submit for Architect review,
2. Nomenclature.
   a. Mogul & Builders Hardware Cylinders: Use the nomenclature and procedures of "Keying Procedures, Systems, and Nomenclature" published by DHI.

G. Templates
1. Furnish templates to ensure proper preparation of the doors and frames for hardware.
2. Process templates in accordance with "Recommended Procedure for Processing Hardware Schedules and Templates" published by DHI.

H. Test Reports
1. Where products, materials, and procedures are specified by reference to tests or standards requiring specific tests, submit two copies of notarized certificates of performance, showing satisfactory completion of specified tests and conformance to standards. Acceptable evidence shall be one of the following:
   a. Listing in product directory published by the organization sponsoring the standard or a nationally recognized testing laboratory.
   b. Manufacturer's literature showing conformance with the standard.
   c. Notorized letter from the manufacturer attesting to compliance with the standard.

I. Operation and Maintenance Manuals.
1. Maintenance manuals: Furnish two (2) copies of manufacturer's maintenance manuals for the products to be used on this project. Include parts lists and detailed instructions for maintenance
2. Operation Manuals: Furnish two (2) three ring binders. Include:
   a. Name, address, and phone number of:
      1) Detention Equipment Contractor.
      2) Manufacturers of products used.
      3) Local representative of manufacturers.
   b. Copy of final hardware schedule.
   c. Copy of final keying schedule.

1.6 QUALITY ASSURANCE

A. Detention Equipment Subcontractor (DES) Qualifications:
1. Experienced in providing and servicing detention equipment including, but not limited to, detention locks and hardware, locking devices, and control systems.

2. Welders qualified by the American Welding Society's testing procedures.
3. Employs at least one full time personnel with a minimum of five years experience in providing detention equipment and detention electronic security systems to supervise this project.
4. Employs personnel capable of providing service for detention equipment.
5. Factory-authorized distributor for the manufacturer of the detention locks and hardware specified.

B. Detention Equipment Contractors (DES):
1. The following are pre-qualified and acceptable:
   a. Stronghold Industries, Brookfield, WI (262-853-0657).
   b. Valley Security Co., Elgin, IL (708-554-0900).
   c. WDSI, Cedarburg, WI (262-377-7621)
2. Other Detention Equipment Subcontractors may request pre-qualification by providing the following information to the Architect at least ten (10) days prior to the bid due date. After review and investigation, if the DES is pre-qualified, it will be in the form of an addendum to this specification.
3. Evidence showing compliance with Contractor's Qualifications required by this specification.
   a. Experience:
      1) Minimum five years' experience in providing and servicing detention equipment including locks and hardware, locking devices, and security control systems.
      2) Regularly provides service and service contracts in the geographical area of this project.
      3) Has a history of satisfactory completion of at least ten (10) projects of similar scope and size as this project.
   b. Personnel:
      1) Employs full time personnel with a minimum of five years experience in furnishing detention equipment.
      2) Uses Welders qualified by the American Welding Society's testing procedures.
      3) Service personnel qualified to provide service for detention equipment.
      4) Evidence that DES has service office based within 100 miles of the project.
      5) Provide a list of employees in supervisory capacity. State their area of responsibility and their years of experience in that capacity.
4. References:
   a. Project lists: Furnish project name, date of contract, person and phone number to contact at project, and the amount of the subcontract for detention equipment.
      1) 5 projects, comparable in size and construction, on which DES has provided detention equipment within the past five years.
      2) 5 projects comparable in size and construction that have been in continuous operation for over 5 years.
5. Names and status of projects on which DES or a predecessor company is and has been involved in litigation.
6. Audited financial statement for the most recently completed fiscal year.
7. Letters of recommendation:
   a. A letter from a specified or acceptable detention lock manufacturer certifying that the DES is currently a factory trained, fully authorized distributor and installer of their complete line of detention products.
   b. A letter from a surety agent stating the DES has the bonding capacity for this project, and that bonding will be allocated to this project if the DES is awarded the subcontract for the detention equipment work.
8. Subcontractors & Suppliers
   a. Name of installation and service companies if it is not done by the DES's own employees.
   b. The name of the ESSS that will be contracted with for the electronic security systems work if that work is specified to be the single responsibility of the DES.

c. A notarized letter signed by an officer of the DES, certifying to the intent to conform fully to this specification.

9. Intent to Conform
   a. A notarized letter signed by an officer of the DES, certifying to the intent to conform fully to this specification.

C. Regulatory Requirements
1. Comply with laws, codes, and ordinances of Federal, State, Local, and other agencies having jurisdiction.
2. Fire rated openings: Comply with NFPA 80, Fire Doors and Other Opening Protectives. Provide hardware that is listed by a nationally listed testing laboratory acceptable to the Authority Having Jurisdiction.
3. Life Safety: Comply with NFPA 101, Life Safety Code.
4. Accessibility: Comply with ICC/ANSI A-1771 unless otherwise required by ADA or more stringent State or local codes.
5. Electrical components: Comply with NFPA-70, National Electrical Code.
6. In case of conflict, the more stringent requirements shall apply.
7. If specified requirements are not in compliance with applicable codes, notify the Architect in writing.
8. Provide items of the same type from a single manufacturer unless otherwise approved by the Architect.

D. Pre-installation Meeting
1. Meet with suppliers and sub-contractors for this and related sections to review installation procedures and workmanship with a special emphasis on unusual conditions to ensure coordination and correct installation procedures.

1.7 WARRANTY

A. Extended warranties:
1. Door closures: Provide manufacturers warranty for ten years from date of substantial completion.
2. Detention locking devices and locks: Provide manufacturers warranty for two years from date of substantial completion.

1.8 DELIVERY, STORAGE, AND HANDLING

A. Packing and Shipping:
1. Mark or tag every item with identification related to final hardware schedule.
2. Pack locks in manufacturer's individual containers
3. Wrap and carton finished components and assemblies to prevent damage.
4. Include screws, bolts, basic installation instructions, and installation templates with every package.
5. Identify contents of every carton by means of a machine printed label.

1.9 MAINTENANCE

A. Preventive Maintenance:
1. In addition to warranty service, provide the following service and inspection.
   a. Inspect, adjust, and lubricate hardware, locking devices, and equipment. Approximately 11 months after date of substantial completion but prior to expiration of extended warranty on locks and locking devices.
   b. Submit written report to the Architect and Owner.

B. Tools: furnish to the Owner, special tools required for maintenance of the detention equipment.
1. Provide Torx Tool Set; Quantity: one (1)
2. Provide Other special tools required for maintenance; Quantity: two (2) of each type.

C. Spare Parts:
   1. Furnish to the Owner, parts for the maintenance of the detention equipment. Pack parts in separate rigid plastic containers suitable for storing parts until needed. Clearly label containers with part number and name. Furnish the following:
      a. Security fastener kit: Plastic compartmentalized box with 25 of each type and finish fastener (Available from Sentry Fasteners, Peoria, IL (309) 693-2800.
      b. Electric limit switches: One (1) of every type used on the project.
      c. Lock solenoids: One (1) of every type used on the project.
      d. Lock motor assemblies: One (1) of every type used on the project.
      e. Locking Device motor Assemblies: One (1) of every hand & type used on the project.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Materials and products specified or shown on the drawings by trade name, manufacturer's name or catalog number establish a level of quality for materials, products, and services.
   1. Other manufacturers desiring approval comply with Section 00 26 00.

B. Provide items of the same type from a single manufacturer unless otherwise approved by the Architect.

C. Products of other manufacturers will be considered for acceptance if the following information is submitted to the Architect at least 10 days prior to bid due date. If a substitution is approved, it will be in the form of an addendum to the bidding documents.
   1. Catalog and technical information.
   2. Notarized certificates stating that:
      a. The product conforms to the requirements of the specification.
      b. The product is equivalent in design, materials, products, and services as that of the specified manufacturer or, if no manufacturer is shown as specified, equivalent to that of the acceptable manufacturers.
      c. The product complies with specified standards.
   3. Agreement to reimburse Owner for costs associated with changing from the specified products.

D. Provide items of the same type from a single manufacturer unless otherwise specified or approved by the Architect.

E. Abbreviations used for manufacturers:

ABH:	Architectural Builders Hardware, Itasca, IL.
ASSA:	Assa, Inc.
Chief:	Chief Industries, Grand Island, NE
Derby:	Derby Industries, South Bend, IN
DDS:	Detention Device Systems, Hayward, CA
Detex:	Detex Corp., New Braunfels, TX
Dorma;	Dorma, Reading, Pa.
FA;	Folger Adam Products from Southern/Folger Detention Co., San Antonio, TX.
GJ;	Glynn Johnson, Indianapolis, In.
Hager:	Hager Hinge Co., St. Louis, Mo.
IDS	Innovative Detention Systems, Shorewood, Il
Ives:	Ives, Indianapolis, In.
Jails:	Jails Correctional Products, Minster, OH
LCN:	LCN Closers, Princeton, IL
NG:	National Guard, Memphis, Tn.
Norton:	Norton Closers, Charlotte, NC
Norix:	Norix Group, Inc., West Chicago, IL
Pemko	Pemko Manufacturing

PLS:	PLS Frame Set, 502-538-9690
PSI:	PSI, LLC. Minneapolis, MN
Rockwood:	Rockwood Manufacturing Co., Rockwood, Pa.
Sargent:	Sargent Lock Co., New haven, CN
Securitech:	Securitech Group, Inc., Maspeth, NY
Southern:	Southern Steel Products from Southern/Folger Detention Co. San Antonio, TX.
Tiffin:	Tiffin Metal Products, Tiffin, Oh
Trimco:	Triangle Brass Manufacturing Co., Inc., Los Angeles, CA
Zero:	Zero International, Bronx, NY

2.2 SCREWS AND FASTENERS

A. Material and finish:
   1. Finish exposed fasteners to match item fastened. Make fastener of the same material as item fastened, except use plated brass or stainless steel for aluminum items.
   2. Exposed fasteners: Torx© brand security fasteners unless otherwise shown.
   3. Furnish screws, fasteners, and anchors required for installation.

B. Except where steel doors and frames have steel reinforcement, provide through bolts for fastening surface door closers and overhead holders and stops.

2.3 INSTALLATION TOOLS AND MATERIALS

A. Furnish the following installation tools and materials for use during construction.
   1. Four sets of Torx© security drivers with bits for every size of screw used.
   2. Four sets of other special tools that may be required for installing hardware.
   3. Fifty (50) extra of every type & finish of screws and fasteners used on this project.
   4. PLS Frame Checking Tool.

B. Upon completion of project, deliver installation tools and unused screws and fasteners to the Owner.

C. During construction, provide blank strike plates for doors that do not provide free egress.

2.4 FINISHES

A. Standard Finish Designations: The designations used to indicate hardware finishes are those established by the BHMA and published in ANSI/BHMA A156.18. Unless otherwise indicated, finish exposed items as follows:

MATERIAL	FINISH DESCRIPTION	BHMA
Stainless Steel	Satin Stainless Steel	630
Brass or Bronze-plated	Satin Chrome	626
Steel-plated	Satin Chrome	652
Aluminum	Satin Aluminum	628
Steel –Non plated	Prime Coat Paint Finish	600

B. Zinc coat or galvanize steel material prior to plating or painting.

2.5 CYLINDERS AND KEYING

A. Pin Tumbler Cylinders and Keys
   1. General:
      a. Description: High security restricted side bar type keyway system, designed for use with mogul and builders hardware size cylinders.
         1) Include manufacturer's warranty that the keyway sidebar combination used will not be used on other projects within a 100 mile radius of this project.
         2) Establish a grand master system.
         3) Key individually or in sets as determined by the Owner.
      b. Registration of Keying:

1) Provide keying by the cylinder manufacturer.
2) Arrange for manufacturer to maintain permanent key identification and registration records.
3) Replacement Keys available only from the manufacturer upon written authorization from the Owner.

2. Temporary cylinders:
   a. Provide temporary construction cylinders and a minimum of ten (10) temporary construction keys for pin tumbler locks on the following doors:
      1) Exterior doors
      2) Doors to be used for storage during construction.
      3) Doors to areas where electronic security system controls are located.
3. Standard compliance
   a. Conform to UL 437
4. Keys
   a. Material: Nickel Silver
   b. Minimum size: 1 ½” x 2” long 1/8” thick.
   c. Quantity:
      1) Provide two keys per lock cylinder. Cut keys as directed by the Owner but not less than six keys per lock set.
      2) Provide six of each master and grandmaster key.
   d. Stamping of Keys:
      1) Stamp keys with an identification code in accordance with “Keying Procedures, Systems, and Nomenclature” published by DHI.
      2) Stamp lets: “Do Not Duplicate”.
5. Cylinders:
   a. Mogul cylinders and tumbler sets.
      1) High security, six-pin tumbler cylinder.
      2) Material:
         a) Body: 1 ½” diameter, machined from minimum 2” diameter brass alloy bar.
         b) Bottom pin tumblers and cylinder balls: Stainless Steel.
         c) Top and side tumblers: Brass
      3) Construction:
         a) Minimum six pin tumbler.
         b) Hardened steel inserts to resist drilling.
         c) UL 437 listed.
      4) Finish: Plated.
   b. Commercial type cylinders & tumblers:
      1) High security, six-pin tumbler cylinder.
      2) Material:
         a) Body: Machined from brass alloy bar stock.
         b) Pin tumblers: Nickel Silver or Brass.
         c) UL 437 listed.
         d) Finish: Plated.
      3) Marking of Cylinders:
         a) Mark body of cylinders with an identification code in accordance with “Keying Procedures, Systems, and Nomenclature”, published by DHI. Use black indelible ink pen for marking.
6. Manufacturer:
   a. Base: Assa.
   b. Acceptable subject to conformance with specified requirements: Medeco, Multi-Lock.

B. Lever Tumbler Paracentric Cylinders & Keying:
   1. General
      a. Keyed alike in sets.
   2. Keys

a. Size: Not less than 4 ½” long, 7/8” wide x 5/32” thick blade.
b. Overlapping paracentric grooves.
c. Handle: Approximately 2 ¼” x 1 3/8” in size, and separated from the key blade by a ½” x 1 ½”shank.
d. Material: Investment cast or stamped polished silicon bronze alloy.
e. Stamping of keys:
1) Stamp keys with manufacturers code which when decoded identifies the facility.
f. Quantity:
1) Provide two (2) keys per lock. Cut keys as directed by the Owner but not less than six (6) keys per set.

3. Cylinder and Tumbler Sets
a. Minimum six lever tumblers per set.
b. Construction:
1) 0.031” maximum clearance between tumbler gate and locking fence.
2) Fit tumblers to allow .025” of wear before replacement of key is required.
3) Material:
a) Tumblers: Spring temper bronze alloy with a notched gate edge.
b) Cylinder: Investment cast silicon brass alloy.

4. Cylinder shield:
a. Provide a stainless steel cylinder shield for each paracentric key cylinder on exterior doors and other doors where specified.

5. Manufacturer:
a. Same manufacturer as lever tumbler paracentric locks.

2.6 HINGES

A. Quantity.
1. 2 hinges for each door up to 60: high.
2. 3 hinges for each door up to 90” high.
3. 1 additional hinge for each 30” or fraction thereof over 90”.
4. Electric current carrying hinges are not load-bearing. Do not include them in calculating quantities.

B. Type 745 Full Mortise
1. Description.
a. Designed for institutional and detention applications.
b. Full mortise, non-handed, reversible.
c. Capable of supporting a 300 pound door with 3 three hinges.

2. Materials:
a. Hinge leaves: Investment cast stainless steel with integral security stud.
b. Hinge pin: Concealed, stainless steel, non-removable, hospital tip.
c. Permanent lubrication.

3. Dimensions:
a. Overall: 4 ½” x 4 ½”.
b. Leaves: Minimum 3/16” thick with integral security stud, 15/32” Diameter by ½” long.

4. Standards, Conform to:
a. ASTM F 1758, gauge 1.
b. ANSI/BHMA A156.1 type A5181.
c. NFPA 80: When used on labeled fire doors.

5. Fasteners: Eight ¼-20 x ½” flat head Torx© stainless steel tamper resistant screws.

6. Manufacturers:
a. Base: MDS #745
b. Optional: Hager, FA

C. Type 747 Full Mortised, Electrified
1. Description: Electrified institutional hinge:
a. Designed for compatibility with type 745 hinge.

b. Current carrying, non-load bearing, hinge.
2. Material: Investment cast type 304 stainless steel.
3. Fabrication:
   a. 3/16” thick leaves.
   b. Hinge pins: Non-removable, Hospital tip.
   c. Electrical conductors: Five color-coded #18 conductors.
      1) UL recognized wire.
      2) Five foot leads on door leaf.
      3) Three foot leads on jamb leaf.
   d. Non-handed, reversible.
   e. Full mortise.
   f. Size: 4 ½” x 4 ½”
4. Standards: Conform to UL 634 requirements.
5. Quantity:
   a. Provide in addition to load bearing hinges.
   b. Provide where specified in hardware sets.
   c. Provide wherever electrical wiring is required between door and frame even if not shown on schedule.
   d. Provide additional electrified hinges if necessary to provide number of conductors required by electrified hardware.
6. Manufacturers:
   a. Base: IDS #747
   b. Optional: PHC, Hager, FA.

D. Type 3 Utility Hinges
1. Description.
   a. Full surface, heavy duty utility hinge for application to moderate weight doors used on access doors, and cabinets. Non-handed, reversible.
   b. Capable of supporting a 150 lb. door with 2 hinges.
2. Materials
   a. Fabricate from 1/4" thick cold rolled formed steel.
   b. Weld hinge pin after assembly.
3. Size: 3” x 4”.
4. Fasteners: Four 3/8"-16 x 1" button head steel security screws.
5. Finish: Primed for paint.
6. Manufacturer:
   a. Base: IDS #730P
   b. Optional: Hager, FA

E. Type 3FP Food Pass Hinge
1. Description.
   a. Full service, heavy duty food pass hinge for application on food pass doors.
   b. Capable of supporting a 150 lb. door with 2 hinges.
   c. Integral stop limits rotation to ninety degrees.
2. Materials.
   a. Investment cast stainless steel, 1/4” thick.
   b. Weld hinge pin after assembly.
3. Size: 3” x 4”.
4. Fasteners: Four 3/8” -16 flat head stainless steel security screws.
5. Manufacturer:
   a. Base: MDS #738
   b. Optional: Hager, FA

F. Type 5
1. Description.
   a. Heavy duty, full surface hinge for application to security doors, cell doors, and gates. Non-handed.

b. Capable of supporting a 600 lb. door with 2 hinges.
2. Materials:
a. Fabricated from 1/2" thick cold rolled steel.
b. 5/8” stainless steel hinge pin.
1) Weld hinge pin after assembly.
2) Heavy duty polymer thrust bearing.
3. Standards: Conform to ASTM F1758, grade 1 requirements.
4. Size: 5" high.
5. Fasteners: Weld on.
6. Finish: Primed for paint.
7. Manufacturer:
a. Base: IDS #750
b. Optional: FA, Hager

2.7 LOCKS

A. General requirements.
1. Fastenings: Torx tamper resistant screws.

B. Type 1000 Mortise Lock
1. Description:
a. Heavy duty mortise lock.
b. Includes lock, strike, operating trim, mortise cylinders, and adjustable cylinder collars.
c. Provide lever handle trim unless otherwise shown.
2. Standards compliance. Conform to:
a. UL 10C, 3 hour fire rating when specified for fire rated doors.
b. ANSI/BHMA A156.13, series 1000, Operational Grade 1, Security Grade 1.
c. ANSI/BHMA A156.25 (Locks with electrified lock/unlocking)
d. ASTM F1577-05 Test Methods for Detention Locks for Swinging Doors
3. Lock Body
a. Material:
1) Armored front.
2) Case and cover: Stainless steel or wrought steel with corrosion resistant finish.
3) Internal working parts: Stainless steel or steel with corrosion resistant finish.
4) Latch bolt: minimum ¾” throw.
5) Dead bolt: Hardened steel roller inserts. 1” throw.
6) Spindle hubs: Solid.
b. Fabrication.
1) Fits ANSI/BHMA A115 series door preparation.
2) Field reversible handing.
4. Lock functions:
a. Mechanical functions: Unless otherwise indicated, functions shown are described in ANSI/BHMA A156.13.
b. Electrified functions.
1) Suffix E-07-1
a) Controlled electric release trim outside, free egress trim inside.
b) Controlled trim always locked except when unlocked by key or remote switch. (Storeroom function).
c) Request to exit switch in inside trim.
2) Suffix E-07-2
a) Controlled electric release trim both sides.
b) Controlled trims always locked except when unlocked by key or remote switch. (Storeroom function).
5. Strikes:
a. Material: Type 304 Stainless steel.
b. Provide curved lip for locks with latch bolts.
c. Provide corrosion resistant wrought steel dust box.

6. Operating Trim
    a. General:
        1) Spindles: Minimum 11/32” cold drawn steel.
        2) Through bolt mounting.
        3) Include modification of lock body if required by trim manufacturer.
    b. Design:
        1) Provide lever handles and full escutcheons unless otherwise shown.
        2) ¾” diameter x minimum 4-11/16” long tubular design with return.
        3) Material: Type 304 stainless steel.
    c. Vandal resistant – Choice of:
        1) Break away levers with internal slip clutch which allows re-setting lever to normal operating function without replacing parts or removing operating trim from door. Built in restrictor to positively stop the movement of the lever without relying on internal parts of the lock or:
        2) Detention quality lever track assembly. Provides positive stop for trim. Include open bottom to prevent dirt build-up.
7. Other features to be included:
    a. Suffix A: Switch installed behind the strike plate to indicate when the latch bolt is extended into the strike.
    b. Suffix E: Electrified locking/unlocking of operating trim.
        1) Provide plug connectors for wiring connection.
        2) Fail secure operation unless otherwise shown.
        3) Suffix FS: Fail safe operation. Controlled levers unlock if power fails.
        4) Electrical Requirements
            a) 24vdc Thermosol™ protected solenoid operation.
            b) Choice of:
                (1) Control trim with electric solenoid and release mechanism within the trim.
                (2) Electric solenoid and release mechanism concealed in lock body.
            c) Provide 8' leads on motors, solenoids and switches.
            d) Include deadlock indication switch to indicate when latch bolt is deadlocked.
            e) Include request to exit (RTE) switch activated by depressing the lever handle, where door is protected by an alarm system. RTE is required to shunt alarm when exiting.
            f) Include Latch position switch.
8. Manufacturers:
    a. Base: Securitech MLZ series with GG x G3 trim and specified options.
    b. Optional:
        1) FA 9300 series with LT trim and specified options.
        2) Sargent 9200 series with Securitech G3 trim and specified options.
        3) Sargent 9200 series with lever track assembly.

C. Type 17M Food Pass Lock
1. Description:
    a. Latch for use on food passes, wicket doors, observation shutters where deadlocking is not required.
    b. Mogul cylinder, Keyed one side.
2. Operation.
    a. Key retracts latch.
    b. Automatic snap latching on closing. No dead-latch.
3. Material:
    a. Case: Cast steel, zinc plated.
    b. Cover: 1/4" thick, cold rolled steel, zinc plated.
    c. Latch bolt: Investment cast stainless steel, 1” x 7/16” x 7/16” throw.
    d. Working parts: Corrosion resistant.
4. Minimum Size: Lock: 4” x 2 3/4" x 1 ¼”.

5. Options:
    a. Include food pass keeper.
6. Manufacturers
    a. Base: IDS #7M
    b. Optional: FA, Airteq

D. Type 120 Jamb Mounted Electric Lock
1. Description.
    a. Institutional, jamb mounted, electrified mogul cylinder lock for medium/maximum security applications.
        1) Mounts into frame pocket. Designed for 7” medium width jamb.
        2) External mounting holes.
        3) Allows use of flush, removable cover plate for flexibility and ease of service.
        4) Mounts behind frame. No faceplate required.
    b. Includes: Lock, Strike, and Mogul cylinder(s).
2. General Requirements
    a. Provide plug connectors for wiring connection.
    b. Provide switches for interlocking doors in interlocks shown on drawings and where scheduled.
    c. Provide adjustable cylinder collar for mogul cylinders.
    d. Provide cylinder extension to bring cylinder flush with frame face.
3. Materials:
    a. Back Plate: 1/4" reinforced investment cast stainless steel 24vdc Thermosol protected solenoid operation.
    b. Stabilizer cage : 10 gauge steel.
    c. Case, cover: Minimum 10 gauge steel, zinc plated.
    d. Latch bolt, roller bolt: Tool resistant investment cast stainless steel.
    e. Strike: Investment cast stainless steel.
    f. Springs: Stainless steel.
    g. Operating levers: 1/4" zinc plated steel.
    h. Motors (Suffix M): 24 VDC permanent magnet gearmotor operation.
        1) Motor rated at maximum 2.2 amps full load.
        2) Dual motor switches for half or full cycle operation.
        3) Motors” Half cycle (MC) with switch to allow latch to be held back for period of time programmed in controls.
    i. Solenoids (Suffix E):
        1) 120 VAC continuous duty solenoid operation.
        2) Rated at maximum 13.0 amps inrush, 0.75 amps seated.
    j. Switches: SPDT, UL Listed rated for 15amps at 125 or 250 VAC.
4. Minimum Dimensions:
    a. Lock case: 5” x 3 ½” x 12”
    b. Latch bolt: 1 ½” x ¾” x 1” throw x ¾” projection.
    c. Frame pocket size: 8” x 14”.
5. Integral deadlock and latch bolt monitoring switches.
6. Standards:
    a. Conform to ASTM F1577, grade 1 requirements.
    b. U.L. fire door listed when used on labeled fire doors.
7. Cylinders:
    a. Suffix –1S: Keyed one side.
    b. Suffix –2S: Keyed two sides.
8. Function:
    a. Unlocks when energized.
        1) With maintained switch, once unlocked, latch-bolt remains retracted until it is selected to lock. When the switch is released, the latch bolt extends automatically. The position of the door does not affect this operation.

2) With momentary switch, latch bolt remains retracted as long as circuit is energized. (Requires non-holdback option)

b. Suffix “2K: Same as above except knob release on one side. Knob is always active.

9. Exterior use modification
   a. When specified for exterior doors, modify lock with protected electrical wiring, low temperature lubricant, cover gasket, and other modifications required by the manufacturer for the intended use in exterior applications. If the manufacturer cannot provide a 24vdc operated motor lock for exterior application, provide 120 vac solenoid operated lock and relay operated interface to allow operation of the lock with 24vdc controls.
10. Provide 24VDC operation unless otherwise shown or required for exterior application.
11. Options:
    a. Suffix E: 120volt solenoid operation
12. Manufacturers:
    a. Base: IDS 120 series.
    b. Optional: FA, Southern

E. Exit Devices
1. Extra heavy institutional duty with electric latch retraction.
2. Standards:
   a. Conform to ANSI/BHMA A 156.3 Grade 1.
   b. Delayed egress functions also conform to ANSI/BHMA A156.24.
3. Outside trim: Lever handle matching mortise lock handles.
4. Include power and controller, reset switch, signage and other items for complete system.
5. Manufacturers:
   a. Base: Detex Advantex series.
   b. Optional: Von Duprin.
6. Front door receiver column with electrical and mechanical key release both sides unless otherwise shown in schedule.

2.8 DOOR POSITION SWITCHES

A. Type 5340
1. Description:
   a. Compact, surface mounted secure door position switch specifically designed for detention use.
   b. Frame mounted with actuator above top hinge.
   c. Includes Case, Cover, Actuator, Actuator arm, switch, and plug in connector.
2. Material:
   a. Case and cover: 11 gauge mild steel, zinc plated.
   b. Actuator arm: Cold rolled steel, zinc plated.
   c. Switch: UL listed, SPDT contacts, 10amp rated.
3. Construction:
   a. Tamper resistant connection to door.
   b. Adjustable tripper switch to actuate signal device.
   c. Sloped top design.
   d. Allows 180-degree door swing.
   e. Universal mounting.
4. Manufacturer:
   a. Base: IDS 5340
   b. Optional: FA, Southern.

B. Type MS 201
1. Mortised
2. Material:
   a. Body: steel cadmium plated.
   b. Face plate: anodized Aluminum.

3. Construction:
    a. Potted components for protection against shock and moisture.
    b. Switch: SPDT contacts with current ratings:
        1) Current resistive load 1.0 amps.
        2) Power, restrictive load DC 15 watts.
        3) Power, resistive load AC 24 VA.
    c. Current rating at 24v.
        1) Resistive load DC .625 AMPS.
        2) Resistive load AC 1.0AMPS.
4. Size: Face plate 4 7/8” x 1 ¼” x 1/16”.
5. Mounting: concealed when door is closed.
6. Listed for use on labeled fire doors.
7. Manufacturer:
    a. Base: IDS 201.
    b. Optional: FA, Southern.

2.9 DOOR PULLS

A. General requirements:
    1. Construction: Specifically designed for detention use.
        a. Material: Investment cast stainless steel.

B. Type 701
    1. Description:
        a. Raised bar pull.
    2. Fabrication:
        a. Overall length: Minimum 9”
        b. Projections: Minimum 2 3/16”
    3. Manufacturer:
        a. Base: IDS #701
        b. Optional: Rockwood, FA.

C. Type 705
    1. Description:
        a. Recessed flush pull.
    2. Fabrication:
        a. Size: 4” wide x 5” high x 1” depth.
        b. Finger tip recessed grip.
    3. Manufacturer:
        a. Base: MDS #705 Series.
        b. Optional: FA, Southern.

2.10 CLOSERS

A. General requirements
    1. Provide closers where scheduled and provide closers for fire and/or smoke rated doors if not scheduled:
    2. Unless otherwise instructed by the Architect, size according to manufacturer recommendation for specific door size, location, and use.
    3. Designed for vandal resistance and intended for detention applications.

B. Standards:
    1. Conform to grade 1 requirements of ANSI/BHMA A156.4, Performance tests PT-1
    2. Conform to ANSI A117 accessibility requirements on accessible doors.

C. Material:
    1. Cylinder: High strength cast iron or extruded aluminum.
    2. Main Arm and forearms: Extra heavy Forged Steel.
    3. Piston: One piece forged steel.

4. Fluid:
   a. Exterior doors: multi viscosity fluid designed for temperatures from 120 degrees F. to -30 degrees F.
5. Regulating screws: Non critical, tamper resistant.
6. Cover for surface closers: Heavy gauge steel.
7. Fasteners: Torx brand security type.

D. Construction
1. Full rack and pinion mechanism
2. Two independent speed regulating screws (closing speed and latching speed).
3. Adjustable hydraulic back check.
4. Arm joints pinned to prevent disassembly.
5. Provide closers, arms, and brackets for 90-degree swing of doors unless otherwise shown on the drawings, requested by the Architect, or required by Code.
6. Suffix AVB: Advanced variable back check to start back check at approximately 45 degree opening.
7. Suffix T: jam and tamper resistant, low friction track and roller with single lever arms for concealed closers and for track type surface models.
8. Suffix HO: hold open feature.

E. Accessories:
1. Provide brackets, drop plates, space blocks, and other accessories required for installation.

F. Types

Type	Description	BHMA
C-1	Parallel Arm Mount	C02021
C-2	Parallel Arm Mount w/ Stop	C02021 x PT4G
C-3	Regular Arm Mount	C02011
C-4	Overhead Concealed	C05031
C-5	Track Mount	

G. Unless specifically shown otherwise, provide surface closers with arms and brackets for mounting on side away from corridor, except mount on side away from detention areas.

H. Manufacturers
1. Base: LCN
2. Optional: Dorma, Norton, Sargent

2.11 PROTECTION PLATES

A. General Requirements:
1. Material: Stainless Steel, .050” thick.
2. Conform to ANSI/BHMA A156.6.
3. Bevel edges of metal.
   a. Counter sink screw holes and provide oval head fasteners.

B. Kick Plates:
1. Provide on the push side of doors that have a closer and on other doors where shown in hardware sets.
2. Conform to ANSI/BHMA A 156.6.
   a. Type J102.
3. Size:
   a. Height: Unless otherwise specified, 10 inches high.
      1) For doors with bottom rails less than 10 inches, reduce height to ½” less than bottom rail unless otherwise required by accessibility codes.
   b. Width:
      1) 2”less than door width on push side of single doors.
      2) 1” less than door width on push side of pairs of doors and on each side of doors.

C. Mop Plates:
   1. Conform to ANSI/BHMA A156.6, Type J102.
   2. Size:
      a. Height: Unless otherwise specified, 6 inches high.
      b. Width:
         1) 2” less than door width on push side of single doors.
         2) 1” less than door width on push side of pairs of doors and on pull side of doors.

D. Manufacturers
   1. Base: Burns, Rockwood, Hager, Trimco, Ives.

2.12 STOPS AND HOLDERS

A. General requirements:
   1. Provide a stop at every door. Provide holders where scheduled.
   2. Types to use. Unless otherwise specified:
      a. Wall bumpers where wall is solid or reinforced and door swings against the wall.
      b. Floor stops where wall bumpers cannot be used but door swings against a wall or equipment and stop will not be a tripping hazard.
      c. Overhead stops where door does not swing against a wall.
   3. Anchors: Provide product manufacturer’s standard anchors appropriate for material to which stops are to be fastened. Exception: use through bolts for overhead stops and holders.
   4. Material: Stainless steel.

B. Wall & Floor Stops:
   1. Type #760.
      a. Heavy duty detention door stop.
      b. Use:
         1) As floor or wall stop unless otherwise specified.
         2) When used as wall stop. Mount to contact bottom of door.
      c. Material:
         1) Stop: 2" diameter x 3-1/2" long, black 90-durometer silicone rubber.
         2) Post: Steel with 5/8" -11 thread.
      d. Manufacturer: IDS #760
         1) Acceptable: ABH, FA
   2. Wall Bumpers:
      a. Conform to ANSI Al56.l6, type L52251.
      b. Material: Stainless steel.
      c. Manufacturers: Acceptable: GJ, Rockwood, Trimco, Ives.
   3. Floor stop type 200
      a. Conform to ANSI Al56.16, type L02161 or L02141 where door undercut allows. Otherwise, use type L02121.
      b. Manufacturers: Acceptable: GJ, Rockwood, Trimco, Ives

C. Overhead Stops:
   1. General:
      a. Coordinate application with type of closer.
      b. Provide special template where required for use with concealed closers.
      c. Adjustable single point hold open field adjustable from 85 to 110 degrees.
   2. Standards: Conform to ANSI A156.8.
      a. Unless otherwise shown on schedule, provide concealed type 1 for use with surface mounted closers and surface mount type 2 for use with concealed closers.
   3. Manufacturer:
      a. Base: ABH series 1000ADJ and 9000ADJ.
      b. Optional: GJ, Yale.

2.13 THESHOLDS

A. General requirements:
   1. Material:
      a. Base Material: Extruded aluminum.
      b. Gasket Material: Tubular design, solid neoprene.
   2. Screws and fasteners:
      a. Provide threshold manufacturer's recommended screws and anchors for material being fastened to. Where exposed to prisoners, provide security Torx type fasteners.
   3. Standards:
      a. Conform to requirements of ANSI/BHMA A156.21.

B. Types:
   1. Provide flat utility type T1 saddle when used with door sweeps:
      a. 4" wide x ½" maximum height.
   2. Where specified, provide type T2 rabbeted type saddle,
      a. 3-5/8" wide x ½" maximum height.

C. Manufacturers:
   1. Base: Zero
   2. Optional: National Guard, Pemko.

2.14 GASKETING

A. General requirements:
   1. Housing: Aluminum, with anodized clear finish.
   2. Gasket material: Tubular design, solid neoprene.
   3. Screws and fasteners:
      a. Provide gasket manufacturer's recommended screws for material being fastened to.
      b. Torx type security fasteners.
      c. Color matched to item.
   4. Performance: Comply with ANSI/BHMA A156.22.

B. Weather-stripping:
   1. Heads and jambs:
      a. Conform to ANSI/BHMA A156.22, R3B265 (R3264 if used for smoke control). Head and jamb seals with a maximum projection from the frame of .220".
   2. Door sweeps:
      a. Where a flat saddle is used and on other doors where scheduled, provide a bottom door sweep, ANSI/BHMA A156.22, R3A435. Housing: minimum .075: thick extruded aluminum with polypropylene brush and fin seal.
   3. Top protection:
      a. Provide on exterior doors: interlocking water shed assembly.
   4. Manufacturers:
      a. Base: Zero 328.
      b. Optional: National Guard, Pemko.

C. Sound Seals:
   1. Provide sound seal system tested for a rating of a minimum 39 STC when tested with an appropriate operating door.
      a. Include head and jamb seals and heavy duty, grade 1 concealed automatic door bottom.

D. Smoke & Fire Seals
   1. Provide fire rated smoke seals.
      a. For labeled fire doors in a means of egress or opening onto a means of egress.
      b. For other doors where shown in hardware sets.
   2. Maintain minimum required rating.
   3. Include:

a. Head and jambs: Tube type, neoprene gasketing in 1” housing, ANSI/BHMA A156.22, type R3B264.
b. Concealed automatic door bottom.
c. Meeting stiles of pairs of doors:
1) Without overlapping astragals: provide mortised housings with neoprene in one housing.

4. When used on labeled fire doors, provide certificate showing that gasketing has been successfully tested in accordance with ASTM E-152, UL 10B (UL 10C, if applicable), and NFPA 252.

E. Manufacturers:
a. Base: Zero
b. Optional: National Guard, Pemko.

2.15 EQUIPMENT

A. Pistol Lockers
1. Description: high security law enforcement gun locker with six handgun storage compartments. The units have pre-punched holes for easy side-to-side connection. Made in USA.
2. Locking System: Keyless user-definable combination locks that allow patrons to set and change their own combinations.
3. General requirements:
a. Recessed or semi recessed wall mounted as shown on drawings.
b. Each of the compartments contains a proprietary adjustable pistol holder that allows handguns to be stored upright.
c. Ship assembled.
4. Material:
a. Doors: 16 gauge cold rolled prime steel.
b. Frame: 16 gauge cold rolled prime steel.
c. Body: 18 gauge cold rolled prime steel.
5. Construction: Factory assembled. All welded. No protruding rivets. Smooth outside surfaces. Doors flanged with welded corners. Shelves welded secure to body. Hinges continuous, concealed, welded to frame and bolted to door. Pry protection bar conceals cam.
6. Finish: Powder coat paint finish. Architect choice of standard color combinations:
a. 2-tone brown (bronze/sand) or
b. 2-tone gray (charcoal/silver).
7. Dimensions:
a. Overall:
1) Type 0191 Four Door Module: 29 ¼”w x 8”d x 15 ½”h.
2) Type 0192 Six Door Module: 29 ¼”w x 8”d x 22 ¾”h.
3) Type 0193 Eight Door Module: 29 ¼”w x 8”d x 30”h.
4) Type 0193 Eight Door Module: 29 ¼”w x 8”d x 30”h.
b. Each door opening: 12.63" W x 8" D x 6" H.
8. Manufacturer: Precision Locker Company, 181 Blackstone Avenue, Jamestown, NY 14701
9. Model: Commander® Pistol Locker (2x3), STL23-260430PC (Keyless)

2.16 FOOD PASS ASSEMBLIES

A. Provide food pass assemblies for door where shown on drawings or specified in the hardware set schedule.
1: Lock: Type 17M mogul key type
2: If not provided with the detention hollow metal doors, provide:
a. Two hinges: type 3FP.
b. Pull: type P2.
c. Plate steel door.

2.17 FURNITURE

A. Chairs
   1. Scope:
      a. Designed for severe contract applications and engineered for institutional durability.
      b. Recommended by the manufacturer for continuous daily use in a correctional environment.
   2. Construction:
      a. One piece injection molded high impact grade copolymer polypropylene with U.V. light stabilizers and anti-static additive.
      b. Minimum 1-1/2" deep x "X" type ribs on underside of the seat connecting legs diagonally.
      c. Chemically resistant to acetone, blood, vinegar, urine, feces, salt solutions, and chlorine solutions.
   3. Conform to the following standards:
      a. ISO 9001 Quality certified manufacturer.
      b. ASTM F 1561-94, Parts A & B.
      c. Furniture Industry Research Association grade 5, Severe Contract Applications, 200,000 cycles.
      d. Federal Aviation Administration Tests 25-853A & B, Appendix F, Part 1.
      e. California Technical Bulletin 133, Flammability Test Procedure for Seating Furniture for Use in High Risk and Public Occupancies.
   4. Colors: Architects choice from a minimum of eight standard colors.
   5. Base: Norix, model C110.

B. Tables
   1. Scope: Institutional table; wall mounted and 2 legs.
   2. Construction:
      a. Legs: 4" diameter steel tubing with 14 gauge wall thickness.
      b. Tops: Nu-stone fiberglass filled polyester composite.
      c. Wall Bracket: Minimum 1-1/2" x 1-1/2" steel.
      d. Size as shown on the drawings.
      e. Base: Norix LB4200 series. Modified for wall mounting.

PART 3 - EXECUTION

3.1 INSTALLERS

A. Install detention equipment in place and put in operation under the supervision od a trained, qualified supervisor, experienced in the installation of detention equipment.

B. Welders: Use only welders and tackers who are qualified by the American Welding Society's testing procedure.

3.2 INSPECTION

A. Site verification of conditions:
   1. Verify that doors and frames are within the specified tolerances before installing hardware.
   2. Examine surfaces, anchors, and finish of materials to receive detention equipment. Report unsatisfactory conditions to the Architect.
   3. Use PLS tool (available at 502-538-9690) to verify that frames are plumb, level, and square.

B. Verification of products:
   1. Compare material to be installed with approved samples. Advise Architect of any differences.

3.3 PREPARATION

A. Protection:
   1. Protect adjacent surfaces prior to installing detention products.

B. Surface preparation:
   1. Surfaces to be welded: Clean of loose scale, rust, oil, grease, paint, and other foreign matter.

3.4 INSTALLATION

A. General:
   1. Install in accordance with the manufacturer's instructions and recommendations.
   2. Set level, plumb, and true to line and location. Adjust and reinforce the attachment substrate as necessary for proper installation and operation.
   3. Drill and countersink units that are not factory prepared for fasteners.
   4. Where cutting and fitting is required to install hardware or equipment onto or into surfaces that are to be painted or finished, install each item and then remove and store in a secure place. Do not install surface mounted items until finishes have been completed.
   5. Where reinforcing and/or mounting plates and supports are required for surface mounting of hardware, use mild steel properly drilled and tapped to receive hardware fasteners.

B. Hardware Locations.
   1. Mount hardware at heights published in the "Recommended Locations for Builders Hardware" published by DHI unless otherwise shown or required to comply with governing regulations.
   2. Door Swing: Mount hardware to allow door swing shown on the drawings except:
      a. Where otherwise directed by the Architect.
      b. Doors shown as 90 degree swing, locate hardware for 110 degree swing if wall conditions and equipment layout permit.

C. Thresholds:
   1. Cut and fit thresholds to profile of door frames, with mitred corners and hairline joints.
   2. Fasten with No. 10 or larger screws of the proper type for permanent anchorage. Use fasteners made of stainless steel or bronze material.
   3. Set thresholds in a bead of butyl rubber or polyisobutylene sealant to exclude moisture. Completely fill concealed voids.

D. Electric Locks:
   1. Exterior Application:
      a. Provide foam seal on lock cover of frame mounted locks.
      b. Caulk perimeter of lock pocket cover with silicon sealant.

E. Closers:
   1. Install surface closers on side of door opening away from corridors except in detention areas, install on side of opening away from holding areas.

F. Stops:
   1. Install floor stops to come in contact with door as near the lock edge as possible.
   2. Install wall bumpers to contact against center of knobs and levers.
   3. Do not install floor stops where they will be a tripping hazard.

G. Mirrors and Back plates
   1. After installing back plates and mirrors, seal gap between mirror frame and wall by caulking with pick resistant caulking.

H. Welding
   1. Execute welding in accordance with the American Welding Society's "Structural Welding Code AWS D1". Use Arc welding in fabrication and erection work where practical.
      a. Welds shall be neat, have a clean appearance, and be deep penetration in accordance with AWS standards. Joints shall be tight and true with members ground to assure a tight fit.
      b. Welds shall be uniform section and smoothness without overlaps and a minimum of craters, porosity, and clinkers.
      c. Remove projecting burrs, edges, or rough spots by grinding. Grind smooth plug welds where exposed to view.

d. Visual inspection of edges, end fillets, and butt joints shall show good fusion width and penetration into base metals.

2. Take precautions to minimize stress and distortions due to heat.
3. Repair of defective welds by adding new material over the defects is not permitted.

I. Fastenings:
1. Fasten detention equipment components to each other and to building construction as detailed or as otherwise required to provide a secure, permanent installation.
2. Where fastening spacing or sizes are not shown, use spacing and sizing of bolts, screws, and welds that will:
   a. Develop the full strength of the members being fastened.
   b. Cause failure due to over stressing to occur in the members before occurring in the fastenings.
3. Use embedded steel shapes for fastening to concrete and unit masonry.
4. Fastenings for components that must ne removed for servicing, maintenance, and replacement shall be Torx security heads except where otherwise shown.
5. Permanent fastenings shall be weld, snap-off head prison screws, or rivets unless shown otherwise.

3.5 REPAIR/RESTORATION

A. Touch up painting
1. Immediately after installation, sand areas where prime coat has been damaged and touch up with same primer as applied by the manufacturer.
2. Remove rust before touch up primer is applied.

3.6 FIELD CQUALITY CONTROL

A. Supervision: Include the services od a qualified, trained technician to supervise the installation and activation of products included in this section.

3.7 ADJUSTING

A. Adjustment:
1. Check and adjust operating hardware and doors to ensure proper function and operation.
2. After the building is completed and in use, make final adjustments to compensate for air movement and other conditions.

B. Lubrication: Lubricate moving parts with lubricant recommended by the manufacturer.

C. Remove items that cannot be adjusted to operate properly and smoothly. Replace with new products.

D. After installation, arrange for the closer manufacturer to inspect and adjust closers to ensure proper adjustment and operation.

E. Approximately six months after acceptance of the project, examine the equipment for proper operation, and readjust, clean, lubricate, and replace parts and equipment for proper operation. Prepare a detailed written report of this inspection for the Architect and Owner.

3.8 CLEANING

A. Clean and polish hardware to restore original factory appearance. Use caution not to remove protective surfaces on plated material.

3.9 DEMONSTRATION AND TRAINING

A. Demonstrate to and instruct the Owner’s personnel on proper operation, maintenance, care, and adjustment of equipment.
1. Provide a minimum of four hours for instruction of Owner’s personnel.

3.10 DETENTION HARDWARE SETS

A. The following schedule of hardware is intended to designate the quantity and type of material required. Changes in this list because of model number changes and changes in function shall be noted in the schedule of detention hardware to be submitted.
*indicates "refer to specification to determine quantity".

Set DE-01
Each door to have:

Quantity	Item	Type
*	Hinges	4.5
*	Electrified Hinge (s)	
1	Exit Device	ELR x Delayed egress
1	Closer, concealed overhead	C4
1	Kick Plate	
1	Stop	
1 set	Smoke seals	
1	Automatic door bottom	
1	Door position switch	

1 OPERATION

Access: Momentary contact switch bypasses alarm and retracts latch.
Key retracts latch but does not bypass alarm.

Egress: Delayed egress. Momentary switch bypasses delay and alarm.

Set DE-02
Each door to have:

Quantity	Item	Type
*	Hinges	4.5
*	Electrified Hinge (s)	
1	Exit Device	ELR
1	Closer, concealed overhead	C4
1	Kick Plate	
1	Stop	
1 set	Smoke seals	
1	Automatic door bottom	
1	Door position switch	

1 OPERATION

Access: Momentary switch bypasses alarm & retracts latch
Key retracts latch but does not bypass alarm.

Egress: Free egress. Momentary switch bypasses alarm.

Note: If provided, green light indicates outside corridor is safe to use.
Red indicates corridor is being used to move detainees.

Set DE-03
Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Mortise Latch Set	1000 x F01
1	Electrified Lock(Jamb mount)	120MC -2S
1	Door Position Switch	5340
1	Closer, concealed	C-4
1	Kick Plate	J102
1	Stop-Heavy duty (Wall mounted)	760
1 set	Smoke seals (fire rated)	
1	Automatic door bottom	

1 OPERATION:

Access: Momentary contact switch bypasses alarm & retracts latch bolt of electrified lock.

Key retracts latch bolt but does not bypass alarm.

Egress: Momentary contact switch bypasses alarm & retracts latch bolt of electrified lock.

Key retracts latch bolt but does not bypass alarm

Emergency release: Maintained contact switch retracts latch bolt until switch is reset.

. Note: Mortise latch is required to maintain fire door latching when in emergency release model. If door is not a rated fire door, use set DE-03A.

Set DE-03A

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Electric Lock (Jamb mount)	120MC-2S
1	Door Position Switch	5340
2	Pulls (Raised)	701
1	Closer, concealed	C4
1	Stop –Heavy duty(Wall mounted)	760
1	Kick Plate	J102

1 OPERATION:

Access: Momentary contact switch bypasses alarm & retracts latch bolt of electrified lock.

Key retracts latch bolt but does not bypass alarm.

Egress: Momentary contact switch bypasses alarm & retracts latch bolt of electrified lock.

Key retracts latch bolt but does not bypass alarm.

Emergency release: Maintained contact switch retracts latch bolt until switch is reset.

Set DE-04

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Mortise Lock (w/ deadbolt)	1000 x F13
1	Closer, concealed	C4
1	Stop –Heavy duty (Wall mounted)	760
1	Kick Plate	J102
1	Mop plate	

1 OPERATION:

Latch bolt operated by lever from either side. Dead bolt operated by key outside or thumb turn inside.

Set DE-05

Each door to have:

Quantity	Item	
*	Hinge	4.5
1	Lock –Classroom Deadbolt	1000 x F29
1	Pull (Recessed)	705
1	Stop - Overhead ANSI.BHMA type C05541	

1 OPERATION: Operate deadbolt by key. Inside deadbolt can retract deadbolt but cannot extend it.

Set DE-06

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Mortise Lock (Storeroom)	1000 x F07
1	Closer, concealed	C4
1	Stop –Heavy duty(Wall mounted)	760
1	Kick Plate	J102

1 OPERATION:

Entry: Key retracts latch. ,.

Egress: Lever retracts latch.

Set DE-07

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Electric Lock (Jamb mount)	120MC-1S
1	Door Position Switch 5	340
1	Pulls (Raised)	701
1	Pull (Recessed)	705
1	Closer, Surface track w/ AVB	
1	Stop –Heavy duty (Wall mounted)	760
1	Food Pass/Cuff port assembly	790
	W/ Lock	17M

1 OPERATION:

Access: Momentary contact switch bypasses alarm & retracts latch bolt of electrified lock Key retracts latch bolt but does not bypass alarm.

Egress: Momentary contact switch bypasses alarm & retracts latch bolt of electrified lock. Emergency release: Maintained contact switch retracts latch bolt until switch is reset.

NOTE:

1. Provide smoke resistant construction. Maximum 3/4" under cut.

Set DE-08

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Electrified Hinge	4.5EH
1	Electrified Mortise Lock	1000 E07-1
1	Door Position Switch	MS-201
1	Closer,	C4
1	Stop, heavy duty	760
1	Kick Plate	J102

1 OPERATION:

Access: Momentary contact switch bypasses alarm and unlocks lever of electrified lock or retracts latch.

Key unlocks lever or retracts latch but does not bypass alarm

Egress: Free egress. Switch in inside lever bypasses alarm

Set DE-09

Each door to have:

Quantity	Item	Type

*	Hinges	4.5
1	Electrified Hinge	4.5EH
1	Electrified Mortise Lock	1000 E07-1
1	Door Position Switch	MS-201
1	Closer,	C4
1	Stop, heavy duty	760
1	Kick Plate	J102

1 OPERATION:

Access: Momentary contact switch bypasses alarm and unlocks lever of electrified lock or retracts latch.

Key unlocks lever or retracts latch but does not bypass alarm

Egress: Free egress. Momentary contact switch bypasses alarm.

Set DE-10

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Electrified Hinge	4.5EH
1	Electrified Mortise Lock	1000 E07-1
1	Door Position Switch	MS-201
1	Closer,	C4
1	Stop, heavy duty	760
1	Kick Plate	J102

1 OPERATION:

Access: Momentary contact switch bypasses alarm and unlocks lever of electrified lock or retracts latch.

Key unlocks lever or retracts latch but does not bypass alarm

Egress: Free egress. Switch in inside lever bypasses alarm

Set DE-11

Each door to have:

Quantity	Item	Type
*	Hinges	4.5
1	Electrified Hinge	4.5EH
1	Electrified Mortise Lock	1000 E07-1
1	Door Position Switch	MS-201
1	Closer,	C4
1	Stop, heavy duty	760
1	Kick Plate	J102

1 OPERATION:

Access: Momentary contact switch bypasses alarm and unlocks lever of electrified lock or retracts latch.

Key unlocks lever or retracts latch but does not bypass alarm.

Egress: Free egress. Switch in inside lever bypasses alarm.

3.11 EQUIPMENT SCHEDULE

A. Pistol (Gun) Lockers .
   1. Locations as shown on drawings.

B. Key Storage Cabinet
   1. Location to be determined by the Owner.

3.12 FURNISHINGS SCHEDULE

A. Stools.
   1. Swing out type:
      a. Where shown on the drawings.

2. Floor mount.
   a. Where shown on the drawings.

B. Tables:
   1. Where shown on the drawings.

3.13 MISCELLANEOUS

A. Spare parts and tools: Refer to 1.10.

B. Installation Tools: Refer to 2.03.

C. Keys: Refer to 2.05

END OF SECTION

SECTION 11 19 20

PLC ELECTRONIC DETENTION MONITORING AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Single Responsibility:
   1. Assign the work of this section to the single responsibility of the Detention Equipment Subcontractor (DES) in Section 11 19 00.
   2. Part 1 requirements of Section 11 19 00 apply to this section.

B. Section includes: Material, labor, and services for the installation of:
   1. Control Center
   2. Security Interface System
   3. Video Wall System
   4. Video Management System
   5. Network Switch
   6. Video Appliance
   7. Router
   8. Access and Egress Control System
   9. IP Camera System
   10. Sound Systems
   11. Interview System
   12. Corridor Status Indication Light.
   13. Lighting Control System
   14. Elevator Control System
   15. Duress Button System
   16. Visitation System
   17. Transient Voltage Suppression
   18. Security System Wiring and Connections
   19. Final adjustments and system check out.

C. Product Supplied But Not Installed Under This Section:
   1. Security Equipment back boxes and cabinets: Installation in Division 26.
   2. Power supplies, transformers, surge protection devices, and line filters required for security system: Installation in Division 26.

D. Products Installed But Not Supplied Under this Section:
   1. Electrical connections to hardware specified in Door Hardware Section.
   2. Electrical connections to hardware specified in Detention Hardware Section.

E. Related Sections:

F. Door Hardware: Coordinate door hardware and electronic security hardware for function
   1. and templating.
   2. Detention Hardware: Coordinate detention hardware and electronic security hardware for function and templating.
   3. Electrical:
      a. Conduit, fittings, junction boxes, and standard electrical back boxes.
      b. Power including circuit breakers, conduit, wire, and terminations to equipment specified in this section.
      c. Nylon pull strings in conduit.
   4. Elevator:
      a. Shall be controlled from consoles only.
      b. Personnel shall call consoles from elevator lobby via intercom.
      c. Consoles sends elevator to floors requested and door opens.

d. Once in elevator personnel call console to request floor from intercom in elevator. When console selects intercom in elevator camera is activated.

5. Phone:
   a. Phone line at security interface system provided by others for remote service and programming.
6. Cameras:
   a. Cameras, video recording appliance, video wall and monitors, video wall interface are to be provided by Control Masters.
   b. This contractor is to provide interface for control console to provide camera follow and call up and connect to video wall computers provide by Control Masters.

1.2 DEFINITIONS:

A. Supply: Furnish materials only.

B. Install: Installation of materials.

C. Provide: Supply and install

1.3 SYSTEM DESCRIPTION:

A. Integrated electronic system providing detention and building security functions.

B. Include tools, equipment, system engineering, supervision, labor, spare parts and materials for an operational electronic security system.

C. PLC shall communicate directly to Keyless Entry System, Sound Systems and other Sub systems to provide a console control of Security Devices from Graphic.

D. Minimum control and status for the following:
   1. Architectural doors.
   2. Detention doors
   3. Intercoms
   4. Cameras
   5. Audio Threshold
   6. Duress
   7. Others points

1.4 SUBMITTALS:

A. Specifications are written around a specified manufacturer which has been reviewed. When submitting an acceptable manufacturer a letter from manufacturer is to be included with the submittal guaranteeing that it meets the specification and takes no exceptions to specification. When using an acceptable manufacturer a product and/or software sample shall be submitted in the submittal. Contractor submitting acceptable manufacturer shall provide a letter that equipment and installation meets IDOC, NFPA and IBC requirements. Letter must be signed by an officer of the company.

B. Within 30 days after award of contract, submit six (6) copies of the following drawings for review for specified and acceptable manufacturer.
   1. Point to point riser and connection drawing showing each device and wire connection.
   2. Wiring diagrams showing wire and cable requirements for each piece of equipment. Include wire types and sizes.
   3. Conduit layout plan on 1/8" scale architectural drawings.
   4. Equipment schedule showing location and function of each device.
   5. Catalog data: Manufacturer's catalog and data information.
   6. Templates for door and frame preparation for door contacts and other hardware. Process in accordance with “Recommended Procedure for Processing Hardware Schedules and Templates”, published by the Door and Hardware Institute.
   7. Power calculations for determining UPS system size and emergency release backup system size.

8. Provide information to show conformance with quality assurance qualifications.
9. Copy of manufacturers UL 508A listing.
10. Sample of continuous graphics with no page mapping.
11. Sample of documentation software.
12. Provide copy of security license in State of Nebraska.
13. Provide MCSE and/or MCITP certificates.
14. Provide certified training certificates from Card Access, Graphical Software and Interview system, and VMS software providers.
15. Submit all the above information as one submittal. Incomplete submittals will be rejected and returned.

C. Within 30 days before graphic computer approval meeting.
   1. Graphic software sample with proposed layout for graphic display. Include detailed operational description of each control point and status indication. Include color description for graphic, each icon.

D. Graphic Computer Approval Meeting:
   1. Arrange for a graphic computer demonstration prior to software installation. Include owner, architect and detention consultant. Demo operation of each monitor and control point. Make changes requested before installation.

1.5 QUALITY ASSURANCE

A. General Requirements:
   1. A qualified Electronic Security Systems Integrator (ESSI) shall design and supply the Electronic Security System.

B. ESSI Qualifications:
   1. Regularly engaged in the design and furnishing of electronic security systems for detention applications.
   2. Factory trained and authorized distributor of the system components to be supplied.
   3. Capable of providing service and support.
   4. A minimum of 5 references of detention\correctional projects. Include contact name and phone number.
   5. Licensed in the State of Nebraska for security.
   6. Must have full time MCSE and/or MCITP certified technician employed during construction of this project.
   7. Certified and trained w/certificates from Card Access, Graphical Software and Interview system, and VMS software providers.
   8. Maintain a certification with personnel on staff during project and warranty period.

C. Pre-Installation Meeting:
   1. Arrange for pre-construction meetings to coordinate installation of electronic security system. Include ESSI (electronic security systems installer), construction manager, electrical contractor, fire alarm provider, door hardware supplier, detention equipment provider and overhead door provider. Provide electronic security drawings to those attending one week before meeting. If drawings were not provided before the meeting a new meeting will be scheduled at a later date.
   2. Furnish attendees at the meetings with a connection diagram of electronic security systems and arrange for the ESSI to explain the operation and requirements of the systems.

1.6 REFERENCES

A. National Electrical Code, NFPA 70 – 2011 edition.

B. UL-508A Industrial Control Systems

C. Americans with Disabilities Act (ADA) - 1990

D. Life Safety Code 101 – 2012 edition.

E. International Building Code – 2003 edition.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Packing and shipping:
   1. Package with bolts, screws, and fastenings for installation.
   2. Pack keys and key cards separately. Identify with Owner's name, factory order number, and contract number.

B. Acceptance at site:
   1. Deliver key cards and keys direct to the Owner via registered mail or personal delivery. If personal delivery, obtain signed receipt from Owner's Representative.

C. Storage:
   1. Store materials above grade in a dry, well-ventilated area.

1.8 JOB CONDITIONS

A. Do not install electronic components until major construction work in the area is completed. Do not install in areas where dust or moisture can contaminate the working parts or where finish can be marred by construction work.

1.9 MAINTENANCE

A. Maintenance parts: Supply the following maintenance parts in see-thru plastic storage containers:
   1. Ten (10) of each type of key furnished.
   2. Ten (10) of each type of fuse furnished.
   3. One interior Camera.
   4. One card reader controller.
   5. One card reader.

PART 2 - PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS:

A. Manufacturer's names, catalog numbers, and trade names are used to establish a level of quality and the operational characteristics for the products and systems specified. Specified materials, products, and services shall be provided unless otherwise approved by change to the bidding or contract documents. Materials, products, and services of manufacturers listed as acceptable may be substituted for approval provided they meet or exceed the specified requirements and meet or exceed the level of quality and service established by the specified manufacturer. Listing of a manufacturer as specified or acceptable does not relieve the manufacturer of the responsibility to comply with the specifications.

B. Equivalent products of other manufacturers will be considered if catalog and technical information is submitted at least fourteen (14) days prior to bid due date and approved by addendum.

2.2 CONTROL CENTER

A. Includes:
   1. Housing
   2. Graphic Control Software
   3. Graphic Control Computer
   4. Push to Talk / Microphone
   5. (LCD) Monitors.

B. Housing:
   1. Unless otherwise shown on the drawings, provide modular security and surveillance support system housing.

a. Designed using standard EIA 19" width rack cabinets of sufficient size to hold equipment specified in this section.
b. Minimum 14 gauge steel channel frames and 18 gauge steel panels.

2. Manufacturers:
   a. Specified:
      1) Winsted Corp
   b. Acceptable:
      1) Ampco
      2) Soundolier

C. Graphic Control Software:
1. For systems with more than one PLC, failure or communication loss to one PLC shall not effect communication to the other PLCs or disrupt or delay control and monitoring of any device unrelated to the failed PLC.
2. Failure of any one graphic computer station, file server, data server, or other networked computer shall not affect the operation of any other station. All graphic computer stations shall communicate directly with the PLCs only for all control and monitoring functions
3. Each graphic computer station shall be configured with all the software and graphic files required for all locations. Each graphic computer shall automatically recognize its intended location upon startup and configure itself accordingly
4. The system shall utilize voice instructions for alerting the operator to alarm conditions and critical control sequences such as interlock, interlock override, emergency release, and other functions. There shall also be a voice annunciation ON/OFF switch to enable and disable the voice instructions.
5. Security application software shall be self-updating All software updates shall be performed so that the operator needs only to exit and restart the security application for the updates to be recognized.
6. Logged event data shall be initially stored on the local graphic computer station, and then periodically transferred to the data-logging computer at intervals adjustable by the facility.
7. Devices shown on drawings and devices in specification shall be controlled by graphic software.
8. Icon Functionality:
   a. System control shall be accomplished through graphical buttons known as icons. System monitoring shall be accomplished through changes in the icon's bitmap graphic and associated virtual led. System activity shall be instigated from a field input, such as an intercom station, or from the graphic computer, such as pushing the “open” icon for a sliding gate. How the system reacts to this activity shall be defined by its function.
   b. Icon state shall have, at a minimum, the following properties:
      1) Bitmap graphic that appears on the icon graphically depict the current state of the device.
      2) Icon shall always be in one and only one of the available states. The states shall always be the same for a given function.
      3) The main color of the Icon and associated virtual LED. Red shall typically indicate non-secure, emergency or alarm functions, activities, or conditions. Yellow shall typically indicate caution conditions such as intermediate steps in control sequences and "access" conditions. Green shall typically indicate a secure condition. Other colors shall be utilized as necessary in a consistent manor.
      4) An associated sound file that plays in repeating intervals. (usually in the alarmed state). Alarm sounds shall be distinctly discernible from each other and from intercom call-in sounds and graphic computer feedback sound.
      5) Alarmed, it shall also indicate what priority has been assigned. All alarms shall be displayed in the event queue sorted first by priority and second by date/time.
      6) Condition changes indicated by flashing the bitmap and associated virtual led flashes on and off or remains constantly on.
      7) All indicates if the event is recorded to the data-logging computer.

8) Icon visible indicates if the Icon is visible or hidden. Hidden Icons shall be used for functions such as PLC alarms where the Icon only needs to be visible in an alarmed state. This minimizes clutter on the graphics.
9) Icon indicates if the status led is visible or hidden.

9. Documentation Software:
   a. General
      1) Electronic documentation system shall be fully functional and not paper documents such as PDF and CAD files.
      2) Touching field symbols on floor plans shall give operator option to select drawings, manuals, cut sheets and WEB link for each device.
      3) Touching a terminal on security interface shall pull up floor plan and device it connects to
   b. Software Links
      1) Physical drawings.
      2) Manufactures Web Site:
      3) Current amps for rack set.
      4) PLC i/o tables
      5) Maintenance Manuals
      6) Interlock Groups
      7) Schedules
10. Maps:
   a. Include icons for electronic security devices and electrified hardware.
   b. Map shall be continuous page. No paging is allowed.
   c. Open architecture software using programmed in Microsoft visual basic. Proprietary software running in widows will not be accepted.
11. General configuration:
   a. All points and systems report to graphic console.
   b. All detention doors and exterior doors alarm when bypassed by keys or propped open for more than 30 seconds.
   c. Authorized ingress shunts alarm.
   d. Interior non-detention doors shall be alarmed for prop open only.
12. Manufacturers:
   a. Specified Manufacturer: Creative Technologies
   b. Acceptable Manufacturers:
      1) Trentech
      2) Southern Steel
      3) Folger

D. Graphic Control Computer:
   1. Tower case with minimum 500-watt power supply.
   2. Intel Quad Core, Minimum 4 GHz, 4 GB Ram, and 256K Caches.
   3. Video Card: Minimum 2GB DDR3
   4. Keyboard: Windows Type 101
   5. Mouse: 3 button optical with scrolling capabilities
   6. Monitor: SVGA 20" Touch Screen
   7. Hard drive: Two (2) 1TB, One (1) for operating systems and one (1) for back up.
   8. Printer: HP Color Printer
   9. DVD-RW: 10 x 8 x 50
   10. Sound card: Minimum 32 bit w/ speakers
      1) Speakers shall be secured so that alarms cannot be silenced by operator.
   11. Modem for remote connection to software provider.
   12. Manufacturer:
      1) Specified: HP

E. Closed Circuit LCD Monitor:
   1. General:

a. 24 inch active matrix TFT diagonal screen.
b. Provide two spot monitors per control console.
c. Four scan types: 1 to 1, Under Scan, Over Scan, Full Scan.
d. Contrast: 500:1
e. Resolution: 1080P
f. Angle Viewing: 170 degrees horizontal, 170 degrees vertical.
g. NTSC/PAL auto recognition.
h. Display modes: Video, S-video, and VGA.
i. Picture in Picture.
j. Menu Languages: English, Chinese, French, German, Italian, Japanese, and Spanish.
k. Mounting options: Desk Top Standard, Optional Rack Mount or Wall Mount three or two knuckle type.

2. Input Connections:
   a. Composite sync signal, 1.0 V (p-p) 75 ohm BNC connector.
   b. Separate V/C signal, mini-DIN connector, 1.0 V (p-p) 75 ohm negative sync, C signal: 0.286 V (p-p) 75ohm negative sync.
   c. -6DBs (400 m Vrms), RCA
   d. VGA Monitor Connector (15 pin) R, G, B 0.7 V (p-p) 75 ohm positive sync.
3. Output Connections:
   a. Composite sync signal, 1.0 V (p-p) 75 ohm BNC connector.
   b. Separate V/C signal, mini-DIN connector, 1.0 V (p-p) 75 ohm negative sync, C signal: 0.286 V (p-p) 75ohm negative sync.
   c. -6DBs (400 m Vrms), RCA
4. Electrical Requirements:
   a. 12 DC / 3 amps (adapter included).
   b. Operating conditions: 32F to 104F, Humidity 20% to 85% RH.
5. Manufacturers:
   a. Specified:
      1) Tatung
   b. Acceptable:
      1) Pelco
      2) Panasonic

2.3 SECURITY INTERFACE SYSTEM

A. Includes:
   1. Enclosure
   2. Power Supplies
   3. System Controller Boards
   4. Programmable Logic Controller
   5. Amplifiers
   6. Battery Back-up Systems
   7. Manufactured and assembled to the UL-508A

B. Enclosure:
   1. Nema 4 free standing enclosure with hinged cover, lock keyed alike, sized as required to accommodate security interface system.
   2. Wire duct for field wiring.
   3. Separate circuit breaker combination ON/OFF switch for each power circuit.
   4. Comply to NEC 70, article 725 with respect to separation of class 1 and 2 wiring.

C. Power Supplies: UL Labeled and Listed
   1. CCTV camera power supply:
      a. Slow blow fused 1.5 amps on primary side.
      b. 4 amp 24vac transformer for ever 8 cameras.
      c. Each camera individual fused with ½ amp slow blow.
      d. Led showing fuse to camera is not blown.

2. Access Control power supply:
    a. 4 amp DC 12/24
    b. Led for AC input, low battery and dc output.
    c. Field adjustable DC voltage range .7 below to 5.0 above.
    d. Individually fused ½ to 4 amp
    e. Led showing fuse to controller is not blown.
3. Door hardware power supply:
    a. 4 amp DC 12/24
    b. Led for AC input, low battery and dc output.
    c. Field adjustable DC voltage range .7 below to 5.0 above.
    d. Individually fused using auto type fuse available at local gas station.
    e. Led showing fuse to controller is not blown.
4. Manufacturer:
    a. Specified:
        1) Camden Door Controls
    b. Acceptable:
        1) Panasonic
        2) Bosh

D. Programmable Logic Controllers
1. General:
    a. Environmental ratings for all components of the PLC system, except programming equipment, shall meet or exceed the following requirements:
    b. Ambient Temperature rating of 0 to 60 C (32 to 140 F) operational and -20 to 70 C (-4 to 158 F) storage.
    c. Humidity rating of 10% to 90% Relative Humidity (non-condensing).
    d. All system modules shall be designed so as to provide for free airflow convection cooling.
    e. Shall meet the following standards: UL Listed, CSA Certified, and CE.
    f. The PLC system shall be designed so that each control area operates totally independent of one another. Failure or loss of a controller shall not hamper the operation of any other controller.
    g. Programmable controller manufacturer must guarantee the availability of replacement/spare parts for a minimum of ten (10) years.
    h. I/O modules and housings must be of a standard type and fully interchangeable with previous PLC series.
    i. Controllers and I/O structures of a single manufacturer shall be capable of being mounted on the same size fixing centers to allow for larger capacity controllers to be installed in the future should the facility require an expansion beyond the limits specified in the original contract documents.
    j. When required, the system must be capable of controlling remote I/O up to a distance of 500 meters (1,640 feet) from the controller, using high-speed links with a minimum data rate of one hundred and eighty seven (187) Kbaud.
2. PLC Central Processing Unit:
    a. The central processing unit (CPU) shall be microprocessor based, encased in a shielded enclosure to provide RFI protection, and shall provide the logic control functions and date transfer based upon the program stored in memory and the status of the inputs and outputs. The controller must be able to support up to 5,120 local I/O.
    b. The processor shall incorporate extensive self-diagnostic features, which will not half the processor. In addition, separate visual indicators will annunciate at the following conditions:
3. Manufacturers:
    a. Specified: Omron, Schaumburg, IL
    b. Acceptable: Modicon

E. Controller Boards:

1. Description:
    a. Modular type screw terminal (phoenix type) with removable direct connectors.
    b. Controls door status, intercom, duress, threshold monitoring and CCTV.
    c. Capable of individually processing information so that failure of central processor does not affect the control and status functions.
    d. Serve as Interface from control center to field devices.
    e. Communicate locally and to control center via RS-485 communication link.
2. Relay Outputs:
    a. Electrical/mechanical relay contacts rated at 125% of inrush current or 10 amps, whichever is greater.
    b. Individually fused lock relay outputs.
    c. Diagnostic / status LED indications.
    d. Selected status indication on Intercom/Threshold relays.
    e. Door control relays shall remain activated for a period of time pre-set from one (1) to thirty (30) seconds after momentary input from control center.
3. Inputs:
    a. Opto-isolated to a minimum of 7500 volts.
    b. Busy and call-in status indicators for Intercom/Threshold devices..
4. Intercom/Threshold Board:
    a. Circuits to monitor for noise levels in excess of pre-determined thresholds.
    b. Automatic level monitoring circuitry.
    c. Individual level adjustments for each zone.
5. Amplifiers:
    a. General:
        1) Provide amplifier for each master intercom control for simultaneous operator communications.
        2) Busy indication when more than one operator has control of remote intercom.
    b. Amplifier Board:
        1) Minimum 15 watts of power at 2 ohms.
        2) Minimum range: 400 hz - 10K hz.
6. Manufacturers:
    a. Specified:
        1) Dukane
    b. Acceptable:
        1) Etech
        2) Rauland

F. Battery Back-up System:
1. Provide UPS battery back-up system for Graphic Control Consoles.
2. Contactor to supply ups for security interface system with generator back-up.
    a. Per NFPA 101, chapter 14.
    b. Automatically transfer within 10 seconds upon failure of power.
    c. Maintain power source for 1.5 hours. If on generator provide 10 minutes.
3. Manufacturers:
    a. Specified:
        1) Best
    b. Acceptable:
        1) Triplite

2.4 VIDEO WALL

A. Video wall will be provided by Control Masters.

2.5 VIDEO MANAGEMENT SYSTEM

A. General:
1. VMS will be provided by Control Masters.
2. PLC provider shall provide interface to Pelco DSSRV series system.

3. Coordinate with Control Masters for interfacing camera call-up.

2.6 ROUTER

A. General:
   1. Provide a router between security network and owner's network.

B. Manufacturer:
   1. Cisco or Equal

2.7 VIDEO APPLIANCE

A. General:
   1. Provide by Control Masters.

2.8 ACCESS AND EGRESS CONTROL SYSTEMS:

A. Keyless Entry System:
   1. General:
      a. The system shall be IP based.
      b. Software shall interface to Microsoft Outlook and Google calendar to schedule events.
      c. LDAP support for AD integration.
      d. Integrator shall provide certification showing that he is certified by software manufacturer on LDAP, Outlook, and Google calendar.
      e. Browser based management with no required plug-ins.
   2. Controller:
      a. Single Door dual reader.
      b. Two open collectors with a total of 450ma for strike and accessories.
      c. POE.
      d. 16,000 event buffer.
      e. AES 128 bit encryption.
      f. Four inputs.
      g. Form C contacts for devices over 450ma.
      h. Manufacturer
         1) Base:
            a) Infinias eIDC32
         2) Optional:
            a) HID Edge
            b) Mercury
   3. Keypad/Card Reader
      a. Exterior/Interior
      b. HID and piczoelectric keypad.
      c. IP68 rated
      d. Mount height as required by ADA
      e. Manufacturer
         1) Specified: HID
         2) Optional:
            a) Excide ID
            b) Barantec
   4. Cards:
      a. Provide 150 Iclass HID Clamshell cards and 100 Fobs.
   5. Server:
      a. Rack Mount 128 door server.
      b. Windows server 2008 R2
      c. Manufacturer
         1) Base: Infinias
         2) Optional:
            a) HP
            b) Dell

2.9 IP CAMERA SYSTEM:

A. General:
   1. By Control Masters.

2.10 SOUND SYSTEM DEVICES

A. General:
   1. Components of sound system shall be furnished by a single manufacturer.
   2. Interface Sound devices to PLC system to automatically call up corresponding camera upon intercom call.

B. Remote intercom stations:
   1. Mounted directly into recessed, standard electrical back boxes.
   2. Personnel shall call consoles from elevator lobby via intercom.
   3. Consoles send elevator to floors requested and door opens.
   4. Once in elevator personnel call console to request floor from intercom in elevator. When console selects intercom in elevator camera is activated.

C. Acceptable manufacturers:
   1. Base:
      a. Creative Technologies
   2. Optional:
      a. Dukane,
      b. Easter Owens

2.11 VIDEO WALL MONITOR

A. General:
   1. By Control Masters.

2.12 INTERVIEW SYSTEM AND BOOKING

A. General:
   1. Supplied by Owner.
   2. Installed by this section.

2.13 CORRIDOR STATUS INDICATION LIGHTING SYSTEM

A. General:
   1. Lights indicate to personnel when personnel are using corridors normally used for transporting to or from holding.
   2. Lights will be controlled by corridor from either control console.
   3. Console shall indicate lights lit.
   4. Color to be determined by owner.

B. Manufacturer:
   1. 371 LED Commander Federal Signal or Equal

2.14 LIGHTING CONTROL SYSTEM

A. General:
   1. Provide lighting control relay with status and control on graphic for zones shown on drawings.
   2. Lights will be controlled by corridor from either control console.
   3. Console shall indicate lights lit.
   4. Color to be determined by owner.

B. Manufacturer:
   1. Douglas Lighting Controls or equal.

2.15 ELEVATOR CONTROL SYSTEM

A. General:

1. Shall be controlled from consoles only.
2. Personnel shall call consoles from elevator lobby via intercom.
3. Consoles sends elevator to floors requested and door opens.
4. Once in elevator personnel call console to request floor from intercom in elevator. When console selects intercom in elevator camera is activated.

2.16 DURESS BUTTON SYSTEM

A. General:
1. Shall provide highest priority alarm to console.
2. Shall automatically call camera to location when selected.

B. Manufacturer:
1. Ademco 269R/270R for Desk Mount.
2. Camden CM-6000 Series for Wall Mount.

2.17 VISITATION SYSTEM

A. General:
1. Supplied by owner and installed by this contractor.
2. Provide a cat 5 cable to locations shown on the drawings.
3. Provide POE switch for visitation system.

2.18 TRANSIENT VOLTAGE SURGE SUPPRESSION:

A. General:
1. Provide Transient Voltage Surge Suppression (TVSS) for each AC power circuit connected to Security Interface Panel(s) and Control Console(s)
2. Provide TVSS for AC\DC copper lines entering building.
3. Provide TVSS for each CCTV camera and Perimeter Detection System mounted on poles and fences. Provide TVSS at both remote device and where cable enters building
4. Install TVSS devices in separate enclosures from the security interface panel and remote devices.

B. TVSS devices for AC Power:
1. Silicone Avalanche Diode type.
2. Bi-polar grade A clamping tolerance.
3. Power on and system alert indication lamps.
4. UL-1449 listed.

C. TVSS for DC power, twisted pair and Coaxial lines:
1. Silicone Avalanche Diode type.
2. Bi-polar grade A clamping tolerance.

D. Manufacturers:
1. Base: Northern Technologies, Inc., Liberty Lake, WA or approved equal.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not install electronic components until major construction work is complete, HVAC systems working, and there is no chance of contamination of the electronics by moisture and construction dust.

3.2 INSTALLATION

A. General:
1. Install in accordance with the recommendations of the manufacturer and the shop drawings.
2. Provide additional relays where required for proper operation of electric locking devices or controls.

3. Access controlled egress and delayed egress shall be wired to fire alarm as required in NPFA.
4. Access controlled egress shall have independent timer as required in NFPA.

B. Wiring:
1. Use stranded wire only.
2. Use color coded wires. Maintain color coding throughout system.
3. Minimum Wire sizes if not shown on drawings. Use wire size required by device to be operated and distance from power supply to device.
   a. Minimum of 16 gauge two wires for power to electric door lock devices.
   b. Minimum of 18 gauge two wires for powered devices.
   c. Minimum of 18 gauge two wires for door contacts, remote releases and miscellaneous status points.
   d. Minimum of 18 gauge two pair twisted shielded for intercom/threshold devices.
   e. Minimum Cat6 for IP and 59 for analog.
   f. Minimum 12 gauge 12 wires for detention doors
   g. Minimum 18 gauge six conductor shielded for keypad/card readers and Cat 6A for communications.
   h. Minimum 18 gauge 2 pair for egress motion detector.
   i. Minimum five 5 pair twisted shielded to computers and Cat 6
   j. Use heavier wire and higher quantities in accordance with Electrical Engineers or manufacturer's recommendations.
   k. Wiring is home run from each device.
4. Minimize splices. No splices allowed on Ethernet cable.
5. Tin ends of wire before connecting to terminals.
6. Install each system's wiring in its own separate conduit unless otherwise approved by the Architect.
7. Wires shall be labeled and tested. Testing results shall be available to owner when requested,

C. Grounding:
1. Ground each component to a good earth ground unless otherwise required by manufacturer’s instructions.

D. Access & Egress Control System:
1. Provide separate AC circuits for Systems and electric locking devices.
2. Line Protection:
   a. Surge and EMI/RFI protection:
      1) Furnish protection on AC power lines in addition to that provided by the manufacturer of the access control system.
   b. MOV and Diode Protection:
      1) Furnish type and size as recommended by the access control system manufacturer.
      2) Provide for each locking device to prevent or reduce inductive voltage kickbacks.
      3) Provide for each low voltage line to door unit.
      4) Provide for each low voltage line to central processor.

E. Intercom and Audio Threshold Systems:
1. Use shielded audio cable.
2. Isolate splices from the conduit system or earth ground.

F. CCTV System:
1. Provide local AC power for Cameras
2. Securely attach brackets and housings with security fasteners:
   a. Use lead shield on solid masonry.
   b. Use toggle bolts for hollow masonry.
   c. Use machine bolts for steel.
3. Anchoring devices shall be rated to support at least five (5) times the equipment weight.

4. Terminate shields at the master control station and insulate at the field device to provide a floating ground.
5. Review viewing area and location of camera and get owner approval before installing.

G. Detention Doors Controls
1. General:
a. The following is standard operation of detention doors. Operation can be adjusted by owner at required graphic console approval meeting.
b. Cells will be normally operated by keys. Cells will be controlled from graphic only during emergency release. Emergency release will be defined at required graphic console approval meeting.
c. Doors alarms shall alarm at console(s).
d. Detention doors requiring free egress the have card reader and/or keypad and/or intercom shall bypass alarm during egress.
e. Detention doors used for evidence shall not be release or controlled for console(s).
f. Doors will sequence during emergency to save power.
g. Detention doors shall be in conduit due to life safety release unless approved by architect.

H. Power protection devices:
1. Provide EMI/RFI filters on AC power lines to the central security command center systems.
2. Provide surge protection for electronic components.
3. Provide MOV's (Metal Oxide Varistors) of the proper size and rating for the voltage used at each AC electric locking device. Use a Diode for DC electric locking device.

3.3 FIELD QUALITY CONTROL

A. Electrical:
1. Install wire in accordance with the general provisions stated in Division 16 and the National Electrical Code.
2. Wiring shall be neat and field dressed in bundles. Allow sufficient extra cable in door units for easy removal of electronic module for service and adjustment.
3. Provide point-to-point, as built wiring diagrams.

B. Labeling: Clearly, logically, and permanently label cable terminations with Brady or equivalent labels.

C. Arrange for the ESSI to inspect the final completed system and certify that the installation of the system complies with their requirements and that of the manufacturers.

D. Before powering up the systems, verify that equipment is protected by EMI/RFI line filters, surge protection devices, and that MOV's are installed on electrified locking devices.

3.4 ADJUSTING

A. Installer:
1. Make adjustments or corrections necessary for operation of the system.
2. Follow the manufacturer’s instructions to program the system in accordance with the Owner's requirements.

B. ESSI
1. Make final adjustments, check operation of the systems, approve the final installation, and instruct the Owner on the programming, use, and operation of the systems.

C. Coordination:
1. Arrange for a qualified representative of the ESSI to be available for 4 days for on-site coordination with Owner and related contractors and suppliers.
2. Days shall be determined by Owner’s Representative.

3.5 DEMONSTRATION

A. Provide a minimum of five (5), four (4) hour training sessions for designated owner's representatives. Training shall include system programming, operation and maintenance. Have owner sign off that required training has been completed and turn document in to architect. Record training and provide DVD(s) to owner for future training.

3.6 MAINTENANCE CONTRACT AND WARRANTY:

A. Provide maintenance service contract for one year unless different in Division 1.
   1. Period of 12 months, starting at substantial completion.
   2. Include routine maintenance visits and respond to service calls during normal working hours, within 1 business day.
   3. Adjust and replace defective parts and components at no cost to owner.
   4. Provide 11 month inspection and have owner sign off that system is in proper working order. Without owner sign-off, warranty will be extended till sign-off is completed.

3.7 OPERATION AND MAINTENANCE DOCUMENTATION:

A. Furnish (3) copies of operation and maintenance manuals consisting of a 3-ring binder including:
   1. Equipment specifications.
   2. Programming instructions.
   3. Maintenance instructions.
   4. 11" x 17" fan-fold copies of as built drawings.
   5. Names and phone numbers to contact for assistance, maintenance, and warranty service.
   6. Documentation Software CD.
   7. Published price list of equipment provided.

B. Furnish one (1) copy set D size as built drawings.

C. Provide three (3) copies of CD’s with operating system, hardware drivers, system software, as built drawings, and other related software and documentation to allow owner restore load system software.

D. Deliver to Owner through architect at time of substantial completion.

END OF SECTION

DIVISION 12

FURNISHINGS

SECTION 12 24 00
MANUALLY OPERATED WINDOW SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes manually operated, roll-up fabric interior window shades including mounting and operating hardware.

B. Provide labor, materials, tools, equipment, and services for Manually Operated Window Shades as indicated, in accordance with provisions of Contract Documents.

C. Completely coordinate with work of other trades.

1.2 REFERENCES

A. NFPA 701-99 –Fire Tests for Flame-Resistant Textiles and Films.

B. GREENGUARD Environmental Institute Children & Schools.

C. US Green Building Council.

1.3 SUBMITTALS

A. Product Data: Manufacturer's data sheets on each product specified, including:
   1. Floor plan.
   2. Under stud partition.
   3. Where partial panel meets wall.
   4. Panels under millwork.
   5. Where door intersects panels.

B. Shop Drawings: Plans, elevations, sections, product details, installation details,operational clearances and relationship to adjacent work

C. Window Treatment Schedule: For all roller shades. Use same room designations as indicated on the Drawings, field verified window dimensions, quantities, type of shade, controls, fabric, and color, and include opening sizes and key to typical mounting details.

D. Selection Samples: For each finish product specified, two complete sets of shade components cloth options and aluminum finish samples representing manufacturer's full range of available colors and patterns. Mark face of material to indicate interior faces.

E. Verification Samples: For each finish product specified, two complete sets of shade components, unassembled, demonstrating compliance with specified requirements. Shade facrric sample and aluminum finish sample as selected, representing actual product, color, and patterns. Mark face of material to indicate interior faces.

F. Maintenance Data: Methods for maintaining roller shades, precautions regarding cleaning materials and methods, instructions for operating hardware and controls.

G. Manufacturer's Certificates: Certify products meet or exceed specified requirements.

1.4 QUALITY ASSURANCE

A. Manufacturer's Qualifications: Obtain roller shades through one source from a single manufacturer with a minimum of twenty years experience in manufacturing products comparable to those specified in this section.

B. NFPA Flame-Test: Passes NFPA 701. Materials tested shall be identical to products proposed for use.

C. Mock-Up: Provide a mock-up of one of each type roller shade assembly secified for evaluation of mounting, appearance and accessories.
   1. Locate mock-up in window(s) designated by Architect.
   2. Do not proceed with remaining work until mock-up is accepted by Architect.

1.5 DELIVERY, STORAGE AND HANDLING

A. Do not deliver window shades until building construction/renovation within spaces where shades will be installed is substantially complete.

B. Deliver products in manufacturer's original, unopened, undamaged containers with labels intact.

C. Label containers and shades according to Window Shade Schedule.

D. Store products in manufacturer's unopened packaging until ready for installation.

1.6 SEQUENCING

A. Ensure that locating templates and other information required for installation of products of this section are furnished to affected trades in time to prevent interruption of construction progress.

B. Ensure that products of this section are supplied to affected trades in time to prevent interruption of the construction progress.

1.7 PROJECT CONDITIONS

A. Install roller shades after finish work and ambient temperature, humidity and ventilation conditions are maintained at levels recommended for project upon completion.

1.8 WARRANTY

A. Hardware and Shade Fabric: Manufacturer's twenty-five year limited warranty.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Acceptable Manufacturers:
   1. Base:
      a. Draper, Inc., Spiceland, IN.
   2. Optional:
      a. Requests for substitutions will be considered in accordance with provisions of the General Conditions.

2.2 MANUALLY OPERATED WINDOW SHADES

A. Manually Operated Window Shades with Independent Control: Manually operated, vertical roll-up, fabric window shade with components necessary for complete installation; Manual FlexShade XD as manufactured by Draper, Inc.
   1. Operation: Bead chain and clutch operating mechanism allowing shade to stop when chain is released. Designed never to need adjustment or lubrication. Provide limit stops to prevent shade from being raised or lowered too far.
      a. Clutch mechanism: Fabricated from POM thermoplastic with welded 0.354 inch (9 mm) primary steel post with rotational bearing, overrunning design, and positive mechanical engagement of drive mechanism to tube. White or Black color as selected by Architect. Center bead chain placement for right or left hand operation and accommodates side channel with no adjustment of chain location.
      b. Bead chain loop: Stainless steel bead chain.
      c. Bead chain loop: Polyester bead chain, Ivory, Grey, White, Bronze or Black color as selected by Architect.
      d. Bead Chain Hold Down: P-Clip.
      e. Bead Chain Hold Down: Spring-Loaded Tensioner.

2. Rollers: Extruded aluminum roller tube of appropriate diameter to support shade fabric with minimal deflection.
    a. Minimum Roller Tube Diameter: 1.56 inches (40 mm).
    b. Fabric Connection to Roller Tube: Spline fabric/roller attachment system to allow shade fabric to be removed from roller without having to remove roller from brackets.
    c. Fabric Length: 6 inches (152 mm) greater than window height minimum.
    d. Bottom Slat: 13/16 inch (20.6 mm) aluminum dowel, encased in bottom hem with heat sealed ends.
    e. Orientation: Regular from back of roller.
    f. Orientation: Reverse from front of roller.
3. Mounting:
    a. Endcaps only.
    b. Endcaps and fascia.
    c. Endcaps and headbox.
    d. Ceiling pocket.
4. Endcaps: Stamped steel with universal design suitable for mounting to ceiling, wall, and jamb. Provide size compatible with roller size.
    a. Endcap covers: To match fascia or headbox color.
    b. Mounted to ceiling.
    c. Mounted to wall.
    d. Mounted to jamb.
5. Fascia: L shaped aluminum extrusion to conceal shade roller and hardware.
    a. Attachment: Snaps onto endcaps without requiring exposed fasteners of any kind. Fascia can be mounted continuously across two or more shade bands. No notching is required.
    b. Shape: Square Fascia Panel.
    c. Shape: Radius Fascia Panel.
    d. Finish: Clear anodized.
    e. Finish: Black powder coat.
    f. Finish: White powder coat.
    g. Finish: Ivory powder coat.
    h. Finish: Bronze powder coat.
    i. Finish: Custom powder coat as selected by the Architect.
6. Headbox Ceiling/Wall style: Aluminum fabrication with removable closure, endcaps, and back and top cover piece:
    a. Finish: Clear anodized.
    b. Finish: Black powder coat.
    c. Finish: White powder coat.
    d. Finish: Ivory powder coat.
    e. Finish: Bronze powder coat.
    f. Finish: Custom powder coat as selected by the Architect.
7. Headbox, Pocket style: Aluminum fabrication with removable closure, endcaps, and U-shaped pocket:
    a. Finish: Clear anodized.
    b. Finish: Black powder coat.
    c. Finish: White powder coat.
    d. Finish: Ivory powder coat.
    e. Finish: Bronze powder coat.
    f. Finish: Custom powder coat as selected by the Architect.
8. Type D Shade pocket: Rectangular pocket and endcaps designed for recessed ceiling installation of window shades.
    a. Material: Extruded aluminum alloy or steel with white finish.
    b. Size: 5 inches (127 mm) wide by 5-3/8 inches (137 mm) high.
    c. Closure Panel:
        1) 1-1/2 (38 mm) closure dimension, recommended for bead chain operation.

2) 3 inch (78 mm). If selected for CL or XD installer must notch the closure panel to allow the chain to pass through.

d. Pocket Endcap Kit: Metal endcaps with 7/8 inch (22 mm) lip for support of acoustical ceiling panel.

e. Corners: Welded one-piece aluminum sections connecting to and matching pockets to allow continuous shade recess at ceiling corners.

9. Wall Clip with Closure panel: For site constructed ceiling recesses, provide removable closure panel to minimize slot for shade passage but allowing access to shade for maintenance.

a. Material: Aluminum alloy with white epoxy paint finish.

b. Tile Lip: Provide wall clip with 7/8 inch tile lip (22 mm).

c. Closure width: 1-1/2 inches (38 mm).

d. Closure width: 3 inches (75 mm).

e. Closure Width: 5 inches (127 mm).

f. Provide continuous wall clip, 1-3/4 (44 mm) by 3/16 inch (5 mm), for snap-in attachment of closure panel without fasteners.

10. Light Gap Reduction Channels.

a. L Angle – 3/4 inch (19 mm) by 1 inch (25 mm).

b. L Angle -1 inch (25 mm) by 2-3/4 inches (70mm).

c. U Channel -1 inch (25 mm) by 2-1/2 inches (64 mm).

d. H Channel – 1 inch (25 mm) by 5 inches (127 mm).

2.3 FABRIC

A. Light-Filtering Fabrics

1. GreenScreen Revive 1%. GreenScreen Revive is a fire retardant PVC-free fabric constructed of 100 percent polyester yarn, with a minimum of 89 percent Repreve polyester. Repreve is recycled and recyclable, contains low VOC's, and made in the USA. Fire rating: NFPA 701-99 TM#1, California U.S. Title 19, Cradle to Cradle Certified Silver, GREENGUARD, GREENGUARD Children & Schools, Green PVC Free. Approximate Openness Factor: 1 percent. Average Fabric Thickness: 0.019 inch (0.48 mm). Average Fabric Weight: 5.87 ounces per square yard.

2. GreenScreen Revive 5%. GreenScreen Revive is a fire retardant PVC-free fabric is constructed of 100 percent polyester yarn, with a minimum of 89 percent Repreve polyester. Repreve is recycled and recyclable, contains low VOC's, and made in the USA. Fire rating: NFPA 701-99 TM#1, California U.S. Title 19, Cradle to Cradle Certified Silver, GREENGUARD, GREENGUARD Children & Schools, Green PVC Free. Approximate Openness Factor: 5 percent. Average Fabric Thickness: 0.017 inch (.043 mm). Average Fabric Weight: 5.01 ounces per square yard.

3. SheerWeave Infinity2 sustainable window treatment fabric eco-friendly basketweave. Core yarn and coating are PVC-free, lead-free and 100 percent recycable. Fire classification: ASTM E-84 (Class I), NFPA 701-2004 TM#1 (small scale), NFPA 101 (Class A Rating) and CAN/ULC-S 109-03 Large, GREENGUARD, GREENGUARD Children & Schools, Green PVC Free.

a. Average 3 percent open. Average Fabric Thickness: .031 inch (.79 mm) Average Fabric Weight: 13.69 ounces per square yard. Available in 63 inch, 84 inch and 98 inch (1600 mm, 2134 mm and 2489 mm) roll widths.

b. Average 5 percent open. Average Fabric Thickness: .03 inch (.76 mm). Average Fabric Weight: 12.82 ounces per square yard. Available in 63 inch, 84 inch and 98 inch (1600 mm, 2134 mm and 2489 mm) roll widths.

4. SheerWeave Series SW3000 by Phifer: Vinyl coated fiberglass and vinyl coated polyester woven into 62 by 20 mesh. Fire rating: NFPA 701. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. 13.46 oz/sq yd, .028 inches thick. Average 14 percent open.

5. SheerWeave Series SW2000 by Phifer: VOC Emissions: GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2 by 2 basket weave. Fire rating: NFPA 701-1999TM#1 (small scale), NFPA 101 (Class A Rating), UBC (Class 1). Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. 14.26 oz/sq yd, .019 inches thick. Series SW2000 average 5 percent open.
6. SheerWeave Series SW2100 by Phifer: VOC Emissions: GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2 by 2 basket weave. Fire rating: NFPA 701-1999TM#1 (small scale), NFPA 101 (Class A Rating), UBC (Class 1). Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. 14.26 oz/sq yd, .019 inches thick. Series SW2100 average 10 percent open.
7. SheerWeave Series SW2500 by Phifer: VOC Emissions: GREENGUARD Children & Schools -certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave. Fire rating: NFPA 701. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series SW2500, 1 percent open, .024 inches thick.
8. SheerWeave Series SW2400 by Phifer: VOC Emissions: GREENGUARD Children & Schools -certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave. Fire rating: NFPA 701. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series SW2400, 3 percent open, .019 inches thick.
9. SheerWeave Series SW2900 by Phifer: VOC Emissions: GREENGUARD Children & Schools -certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave. Fire rating: NFPA 701. Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. Series SW2900, 5 percent open, .017 inches thick.
10. SheerWeave Series SW2600 by Phifer: VOC Emissions: GREENGUARD Children & Schools -certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. 500 denier fiberglass, vinyl coated and woven into a 2 x 2 basket weave. Fire rating: NFPA 701. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series SW2600, 10 percent open, .017 inches thick.
11. Series SW2701 SheerWeave: Duplex basketweave fabric—light exterior color combined with dark interior color for thermal comfort and view-through. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701. SW2701—.1 percent open.
12. Series SW2703 SheerWeave: Duplex basketweave fabric—light exterior color combined with dark interior color for thermal comfort and view-through. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701. SW2703—3 percent open.
13. Series SW2705 SheerWeave: Duplex basketweave fabric—light exterior color combined with dark interior color for thermal comfort and view-through. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701. SW2705—5 percent open.
14. Series SW2710 SheerWeave: Duplex basketweave fabric—light exterior color combined with dark interior color for thermal comfort and view-through. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701. SW2710—10 percent open.
15. SheerWeave Series SW5000 by Phifer: Polyester and vinyl coated polyester woven into a 42 by 20 mesh. Fire rating: NFPA 701 TM#1/California Technical Bulletin 117 Sect. E. Part 1/NFPA 101 (Class A Rating)/UBC (Class 1)/British Standard 5867. Bacteria and Fungal Resistance: ASTM-G21 and ASTM G 22. 12.3 to14.5 oz/sq yd, .035 inches - .044 inches thick, depending on color. 5 to 10 percent open, depending on color.

16. SheerWeave Series PW4400 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/NFPA 101 (Class A Rating)/UBC (Class 1)/British Standard 5867/NFPA 701-TM#2 large scale/CAN/ULC S109-M-87. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series PW4400 Average 3 percent open, 20.7 oz/sq yd, .037 inches thick.
17. SheerWeave Series PW3500 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/NFPA 101 (Class A Rating)/UBC (Class 1)/British Standard 5867/NFPA 701-TM#2 large scale/CAN/ULC S109-M-87. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series PW3500 Average 5 percent open, 19.2 oz/sq yd, .036 inches thick.
18. SheerWeave Series PW4100 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/NFPA 101 (Class A Rating)/UBC (Class 1)/British Standard 5867/NFPA 701-TM#2 large scale/CAN/ULC S109-M-87. Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series PW4100 Average 10 percent open, 17.5 oz/sq yd, .035 inches thick.
19. SheerWeave Series PW4600 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/British Standard 5867 Type B/ASTM E 84 (Class 1). Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. Series PW4600, Average 3 percent open, 17.4 oz/sq yd, .030 inches thick.
20. SheerWeave Series PW4500 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/British Standard 5867 Type B/ÅSTM E 84 (Class 1). Bacteria and Fungal Resistance: ÅSTM G 21 and ÅSTM G 22. Series PW4500, Average 5 percent open, 14.4 oz/sq yd, .024 inches thick.
21. SheerWeave Series PW4650 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/British Standard 5867 Type B/ASTM E 84 (Class 1). Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. Series PW4650, Average. 3 percent open, 13.3 oz/sq yd, .026 inches thick.
22. SheerWeave Series PW4550 by Phifer: Vinyl coated polyester yarn woven into basketweave pattern. Fire rating: NFPA 701 TM#1(small scale)/California U.S. title 19 (small scale)/British Standard 5867 Type B/ASTM E 84 (Class 1). Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. Series PW4550. Average 5 percent open, 12.5 oz/sq yd, .025 inches thick.
23. SheerWeave PW4800 by Phifer: Vinyl coated polyester with maximum UV blockage. Fire rating: NFPA 701-1999 TM#1(small scale)/California U.S. title 19 (small scale)/NFPA 101 (Class A Rating)/UBC (Class 1)/British Standard 5867. Bacteria and Fungal Resistance: ASTM G 21 and ASTM G 22. 1 percent openness factor. 18.5 oz/sq yd, .030 inches thick.
24. SheerWeave - Basic by Phifer. An economical alternative to traditional solar screen fabrics. Fire Rating: California U.S. Title 19 (small scale), NFPA 701-2004 TM#1 (small scale), NFPA 101 (Class A Rating), UBC (Class I), BS 5867 2008 Part 2 Type B Performance, CAN/ULC-S109-03 (large and small scale) and NFPA 701 TM#2 (large scale), GREENGUARD, Microban. Average 3 percent Openness. Average Fabric Thickness: .025 inch. Average Fabric Weight: 16.4 ounces per square yard. Average 5 percent Openness. Average Fabric Thickness: 0.022 inch. Average Fabric Weight: 14.1 ounces per square yard.
25. E Screen ME-01 Series by Mermet: PVC coated fiberglass yarn woven in 2 by 2 basketweave. .016 inches thick. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701, both small- and large-scale tests/California U.S. Title 19. ME-01 Series: Avg. 1 percent open.

26. E Screen ME-03 Series by Mermet: PVC coated fiberglass yarn woven in 2 by 2 basketweave. .016 inches thick. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701, both small- and large-scale tests/California U.S. Title 19. ME-03 Series: Avg. 3 percent open.
27. E Screen ME-05 Series by Mermet: PVC coated fiberglass yarn woven in 2 by 2 basketweave. .016 inches thick. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701, both small- and large-scale tests/California U.S. Title 19. ME-05 Series: Avg. 5 percent open.
28. E Screen ME-10 Series by Mermet: PVC coated fiberglass yarn woven in 2 by 2 basketweave. .016 inches thick. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701, both small- and large-scale tests/California U.S. Title 19. ME Series: ME-10 Series: Avg. 10 percent open, 10.3 oz/sq yd. Okotex-labeled.
29. M Screen by Mermet: PVC coated fiberglass in 1 by 2 weave. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701, both small- and large-scale tests/California U.S. Title 19. Okotex-labeled.
    a. 3 percent openness 12.7 oz/sq yd, .022 inches thick.
    b. 5 percent openness 11.9 oz/sq yd, .022 inches thick.
30. T Screen 9803 by Mermet: PVC coated fiberglass woven mesh. Dark on one side, light on the other. GREENGUARD Children & Schools certified as a low emitting fabric. Manufacturer to supply GREENGUARD Children & Schools certificate. Fire rating: NFPA 701-99 TM #1, California U.S. Title 19. 12.1 oz/sq yd, .028 inches thick. T Screen 9603: Average 3 percent open.
31. Soltis 99 by Ferrari: PVC-coated polyester with silver backing on outside and pre-tensioning process for dimensional stability. 3 percent openness factor. 9 oz/sq yd, .0126 inches thick. Fire rating: NFPA 701. Easily accepts graphics. Recyclable, Okotex-labeled.
32. Vela by Mermet: PVC-free fabric made from 100 percent FR polyester. Approximately 3 percent open. 6 oz./sq. yd., .015 inches thick. 100 percent recyclable. Fire rating: NFPA 701, small-scale test.
33. SilverScreen by Mermet: 36 percent fiberglass and 64 percent vinyl with an ultra-fine layer of aluminum on the backside. Fire classifications: NFPA 701-99 TM#1, M1 NFP 92-503, GREENGUARD, GREENGUARD Children & Schools, RoHS Lead Free, GREENGUARD, GREENGUARD Children & Schools, Oeko-Tex. Approximate Openness Factor: 5 percent. Average Fabric Thickness: 0.020 inch. Average Fabric Weight: 12.86 ounces per square yard.

B. Room Darkening Fabrics
1. SunBloc Series SB9000: Close woven fiberglass base textile with sun-resistant vinyl film bonded to each side, opaque with minimum tensile strength of 190 pounds for warp and 180 pounds for fill. Fire rating: NFPA 701 1006-Test 1. Washable and stain resistant. Wt. 12 oz/sq yd. Same color both sides, .015 inches thick.
2. SunBloc Series SB9100: Close woven fiberglass base textile with sun-resistant vinyl film bonded to each side, opaque with minimum tensile strength of 190 pounds for warp and 180 pounds for fill. Fire rating: NFPA 701 1006-Test 1. Washable and stain resistant. Wt. 12 oz/sq yd. White exterior in all colors, .013 inches thick.
3. Flocke by Mermet: Opaque, PVC-free fiberglass textile with acrylic backing. 17.1 oz/sq yd, .024 inches thick. Fire rating: NFPA 701, both small- and large-scale tests. Antistatic treated. Draper shades made with this fabric are GreenSpec listed.
4. SheerWeave Series SW7000 by Phifer: PVC-free polyester with acrylic foamed backing. .018 inches thick, 10 oz/sq yd, opaque. Draper shades made with this fabric are GreenSpec listed.
5. SheerWeave Series SW7100 by Phifer: PVC-coated Fiberglass laminated with a 2-ply PVC film. Fire rating: NFPA 701.023 inches thick, 19.8 oz/sq yd, opaque.

6. Edessa Twilight by Mermet. 100 percent Polyester with a "fabric" look and feel. Residential rated FR. Fire classifications: ÅSTM E84, GREENGUARD, GREENGUARD Children & Schools, RoHS-Lead Free, PVC Free, GREENGUARD, GREENGUARD Children & Schools. Approximate Openness Factor: 0 percent. Average Fabric Thickness: .020 inch. Average Fabric Weight: 11.4 ounces per square yard.
7. Vizela 1 percent by Mermet: 100 percent fiberglass with an EVA coating and PVC free. Fire classifications: NFPA 701-10 TM#1, California U.S. Title 19, ÅSTM E-84, M1 NFP 92 503, GREENGUARD, GREENGUARD Children & Schools, RoHS Lead Free, PVC Free, ÅSTM G21 Fungal Resistance and ÅSTM E2180 Bacteria Resistance rated, GREENGUARD, GREENGUARD Children & Schools. Approximate Openness Factor: 1 percent. Average Fabric Thickness: 0.013 inch. Average Fabric Weight: 8.7 ounces per square yard.

C. Color and pattern: _____, No. _____.

D. Color and pattern: As indicated in Color Schedule on Drawings.

E. Color and pattern: As selected by Architect from manufacturer's standard range.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Coordinate requirements for blocking and structural supports to ensure adequate means for installation of window shades.

B. Coordinate requirements for blocking, construction of shade pockets, and structural supports to ensure adequate means for installation of window shades.

C. Coordinate installation of recessed shade pockets with construction of suspended acoustical panel ceilings specified in Section 09 51 23.

D. Coordinate installation of recessed shade pockets with construction of suspended gypsum board ceilings specified in Section 09 21 16.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install roller shades level, plumb, square, and true. Allow proper clearances for window operation hardware.

C. Shade pockets:
1. Install shade pockets prior to installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
2. Install shade pockets in conjunction with installation of suspended ceiling system. Attach to supporting structure with screws through top of pocket at 24 inches (610 mm) minimum centers.
3. Install corner pieces securely and in alignment with pockets.
4. Install pocket ends securely and in alignment with pockets.
5. After interior construction is essentially complete, install shade and operating mechanism in pocket.

D. Install the following items to conceal roller and operating mechanism. Do not use exposed fasteners.
1. Fascias.

2. Closure panels.
3. Endcaps.

3.4 TESTING AND DEMONSTRATION

A. Demonstrate operation of shades to Owner's designated representatives.

3.5 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.6 SCHEDULES

A. Refer to Drawings for shade types and locations.

END OF SECTION

SECTION 12 24 14
ROLLER SHADES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Roller Shades, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Obtain roller shades through one source from a single manufacturer.
   2. Minimum twenty (20) years experience in manufacturing products comparable to those specified in this section.

B. Installer Qualifications:
   1. Installer trained and certified by manufacturer with a minimum of ten (10) years experience installing products comparable to those specified in this section.

C. ASTM International (ASTM):
   1. ASTM G21 Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi
   2. No growth for fungi ATCC9642, ATCC 9644, ATCC9645.

D. National Fire Protection Association (NFPA):
   1. NFPA 70 National Electrical Code.
   2. NFPA 701 Fire Tests for Flame-Resistant Textiles and Films.
   3. NFPA Article 100 Electrical components listed and labeled by either UL or ETL or other testing agency acceptable to authorities having jurisdiction, marked for intended use, and tested as a system.

E. Mockup:
   1. Provide a mockup, for manual shades only, of one roller shade assembly for evaluation of mounting, appearance and accessories.
   2. Locate mockup at opening designated by Architect.
   3. Do not proceed with remaining work until, mock-up is accepted by Architect.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Plans, elevations, sections, product details, installation details, operational clearances, wiring diagrams and relationship to adjacent work.

B. Product Data:
   1. Manufacturer's data sheets on each product to be used, including:
      a. Preparation instructions and recommendations.
      b. Styles, material descriptions, dimensions of individual components, profiles, features, finishes and operating instructions.
      c. Storage and handling requirements and recommendations.
      d. Mounting details and installation methods.
      e. Window treatment schedule:
         1) Use same room designations as indicated on Drawings and include opening sizes and key to typical mounting details.

C. Samples:
   1. Provide for each finish product specified,

a. One set of shade cloth options and aluminum finish color samples representing manufacturer's full range of available colors and patterns.
b. One set of shade components, unassembled, demonstrating compliance with specified requirements.
1) Shadecloth sample and aluminum finish sample as selected.
2) Mark face of material to indicate interior faces.

D. Contract Closeout Information:
1. Warranty.
2. Maintenance Data:
a. See Section 01 78 23.
3. Interior finish fire performance data:
a. Provide for each finish material and type specified:
1) Manufacturer's printed information including:
a) Fire class.
b) NFPA test number.
c) Photograph.
2) Proof of purchase.
3) See Section 01 78 26.

1.4 WARRANTY

A. Roller Shade Hardware, Chain and Shadecloth: Manufacturer's standard non-depreciating twenty-five (25) year limited warranty.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURES

A. Roller Shades:
1. Base:
a. MechoShade Systems.
2. Optional:
a. Hunter Douglas Contract.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIAL

A. Transparent Single-Fabric Shadecloth:
1. ThermoVeil by MechoShade Systems, Inc.
2. Single thickness 0.030 IN vinyl fabric.
3. Dense Basket Weave: 1500 Series, 3 percent open.

2.3 COMPONENTS

A. Manual Operated Chain Drive Hardware and Brackets:
1. Adjustable universal, regular and offset drive capacity.
2. Removable fascia with concealed fasteners.
3. Provide shade hardware system that allows for removable regular and/or reverse roll fascias to be mounted continuously across two or more shade bands without requiring exposed fasteners of any kind.
4. Provide multiple shade operation by a single chain operator.
5. Minimum 1/8 IN thick plated steel.
6. Drive Bracket and Brake Assembly:
a. M5 drive sprocket and brake assembly shall rotate and be supported on a welded 3/8 IN steel pin.

B. Drive Chain:
1. No.10 stainless steel chain

2. Rating: 90 LBS, minimum.

2.4 ACCESSORIES

A. Fascia for Shade Type 1:
   1. Continuous extruded aluminum.
   2. Conceal brackets, shade roller and fabric.
   3. Provide bracket / fascia end caps.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using the methods recommended by manufacturer for achieving the best result for the substrate under the project conditions.

3.3 INSTALLATION

A. Install roller shades level, plumb, square, and true according to manufacturer's written instructions, and located so shade band is not closer than 2 IN to interior face of glass.

B. Allow clearances for window operation hardware.

C. Adjust and balance roller shades to operate smoothly, easily, safely, and free from binding or malfunction throughout entire operational range.

D. Clean roller shade surfaces after installation, according to manufacturer's written instructions.

E. Train Owner's maintenance personnel to adjust, operate and maintain roller shade systems.

3.4 PROTECTION

A. Protect installed products until completion of project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.5 SCHEDULE

A. Shade Type 1:
   1. Manual operating, chain drive.
   2. Sunscreen roller shades .
   3. Provide at Door sidelights in Interior of all following Courtrooms.
      a. Courtrooms Locations: County Courtroom 226, County Courtroom 227 County Courtroom 228, County Courtroom 229, County Courtroom 331, Country Courtroom 332, County Courtroom 625.

END OF SECTION

SECTION 12 32 00
ARCHITECTURAL CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Architectural Casework (AC), as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Manufacturer or manufacturer's authorized representative.

B. AWI Architectural Woodwork Standards (AWS).
   1. Grade: Premium, with exceptions indicated.
   2. Exposed cabinet body edges are to be fabricated flush before and after installation of edge banding.

C. ASTM D1037 Standard Test Methods for Evaluating Properties of Wood Base Fiber and Particle Panel Materials.

D. ANSI 208.2: MDF for Interior Applications.

E. Composite Panel Association listed NAUF (No Added Urea Formaldehyde).

1.3 SUBMITTALS

A. Shop Drawings:
   1. Plans of casework at 1/8 IN = 1 FT or larger.
   2. Elevations of casework at 1/4 IN = 1 FT or larger.
   3. Cross reference shop drawings to Contract Documents casework elevations.

B. Product Data:
   1. Typical details of casework construction.
   2. Reports indicating favorable outcome to Wall Cabinet Load Testing.

C. Contract Closeout Information:
   1. Warranty.
   2. Operating and Maintenance data.
      a. See Section 01 78 23.

1.4 WARRANTY

A. Manufacturer five (5) year warranty against defects in materials and workmanship, such as but not limited to delamination, swelling, or warping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Architectural Casework:
   1. Base:
      a. Calmar Manufacturing (Imperial Woodworking).
   2. Optional:
      a. Case Systems.
      b. LSI of America.
      c. TMI Systems Design.

B. Plastic Laminate:
   1. Base:
      a. Formica.
      b. Nevamar.
      c. Wilsonart.

C. Contact Adhesive:
   1. Base:
      a. Wilsonart.
      b. Formica.
      c. Nevamar.

D. Wood Glue:
   1. Base:
      a. Franklin (TiteBond).
      b. Wilsonart (Lokweld).

E. Medium Density Fiberboard:
   1. Base:
      a. Sierra Pine.
   2. Optional:
      a. Georgia Pacific.
      b. Uniboard.

F. Cabinet Hardware:
   1. Base:
      a. Accuride.
      b. Epco.
      c. Hafele.
      d. Blum.
      e. HEWI.
      f. LSI America.
      g. TMI Systems Design.
      h. Rockford Process Control.
      i. Schlage Lock.
      j. Olympus Lock.

G. PVC Edge Banding:
   1. Base:
      a. Doellken-Woodtape.
   2. Optional:
      a. Rehau.
      b. Charter Industries.

H. Plastic Laminate Countertops:
   1. Base:
      a. VT Industries.
   2. Optional:
      a. Firms listed above for Architectural Casework.

I. Sealant:
   1. Base:
      a. See Section 07 92 16.

J. Miscellaneous items:
   1. Products and Manufacturers as listed.

K. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
   1. FSC certified wood components.
   2. No Added Urea Formaldehyde (NAUF) in materials or fabrication.

B. Wood veneer:
   1. Quality:
      a. Grade: A.
      b. FSC certified.
      c. Natural and special characteristics: slight cross bars, inconspicuous burls and pin knots will be allowed.
      d. No mineral streaks, bark pockets, worm tracks, or vine marks allowed.
      e. Maximum grain slope will be 1 IN in 12 IN.
      f. Maximum grain sweep will be 2 1/2 IN in 12 IN.
      g. Occasional flake not to exceed 3/8 IN in width.
      h. Architect to approve flitch samples for color and grain. Supplier of wood components will supply samples and produce wood components within range of samples.
   2. Wood Veneer for Exposed Surfaces:
      a. Red Oak.
   3. Veneer Cut:
      a. Plain Sliced.
   4. Veneer Leaf Match:
      a. Book Match

C. Medium Density Fiberboard (MDF):
   1. ANSI A208.2 Grade 155 MR50.
   2. Exterior grade.
   3. 48 PCF density.
   4. Base: Medex by Sierra Pine.
   5. Core material for plastic laminate casework.
   6. Core material for counters, backsplash, and sidesplashes with sinks.

D. Hardwood:
   1. Solid, S4S.
   2. Species: Quarter sawn red oak.
   3. Grade: AWI Premium grade.

E. Wood Molding:
   1. Species: Quarter sawn red oak for transparent finishes.
   2. Grade: AWI Premium grade.
   3. Sizes and Profile: As detailed on drawings.

F. Plastic Laminate Facings:
   1. Standard: NEMA LD3.
   2. NEMA LD3, Impact rated at 43IN when adhered to MDF.
   3. Thickness and Grade:
      a. Formed surfaces: Post form Grade-HGP, 0.048 IN thick.
      b. Other exposed surfaces: Grade-VGS, 0.028 IN thick.
   4. Backer Sheets for laminated items.
      a. Semi-exposed cabinet liner: Grade-CLS, 0.020 IN thick; color to match LPDL.
      b. Concealed backer sheet: Grade-CLS, 0.020 IN thick; any color.
   5. See Sheet I-001 Interior Finish Schedule for selections.

G. PVC Edge Banding:
   1. Machine applied with waterproof hot melt adhesive.
   2. Edge of case body and exposed components:
      a. Thickness: 1mm.
      b. Color: To match case exterior.

3. Edge of shelves inside plastic laminate clad units:
    a. Thickness: 1mm.
    b. Color: To match shelf.
4. Edges of doors and drawer fronts, exposed finished shelves and removable panels:
    a. Thickness: 3mm.
    b. Color: To match exterior face of panel.

H. Glass:
1. Tempered: Kind FT, Type I, Quality q3, Class 1 and Condition A.
2. Laminated Glass, with transparent butyrate interlayer.

I. Tackboards (TB):
1. Vinyl fabric faced complying with F.S.CCC-W-408, Type II, Class 2, laminated to 1/4 IN cork sheet.
2. Fabric MFG, Pattern and Color: See Sheet I-001.
3. Laminate under pressure to minimum 1/4 IN thick plywood or hardboard backing.
4. Wrap fabric around edges.
5. Provide as noted on IC-series drawings.

J. Factory Stains and Varnishes:
1. Comply with applicable provisions of Architectural Woodwork Quality Standards by AWI, current edition.
    a. Comply with Section 1500; Premium Quality.
2. Washcoat: Prepare wood to accept stain uniformly by application of a compatible washcoat.
3. Stain:
    a. Alkyd based product, compatible with balance of finish system.
    b. Color: To be determined by Architect based on samples of specified wood.
4. Sanding Sealer:
    a. Vinyl based.
5. Clear Topcoat:
    a. Conversion Varnish (formerly AWI finish system TR-4).
    b. Minimum of 2 coats, lightly scuff sand between coats.
    c. Sheen (measured with 60 degree gloss meter):
        1) Satin: 31 to 45 points.

K. Contact Adhesives:
1. Description:
    a. Viscosity: 760 cps.
    b. Density: 7.7 Lbs/gallon.
    c. Solids content: 36 percent +/- 1 percent.
    d. VAHP content: None.

L. Wood Glue:
1. Description:
    a. Bond Strength per ASTM D905: 4,000 psi. at room temperature.
    b. ANSI/HPVA Type I water resistant.
    c. Application temperature: Above 47 degF.
    d. FDA approved for indirect food contact.

M. Sealant:
1. Description:
    a. Silicone sealant in colors matching components.
    b. See Section 07 92 16.
2. Colors:
    a. Colors as required to match Plastic Laminate, Stone, Wood, Solid Surfacing and other materials specified for casework bodies, countertops and splashes.
    b. Architect to select from no less than 400 standard color choices.
    c. Number of different colors required for project shall not be limited.

3. Base Product:
    a. Solid Colors: Color-Sil by Color Rite; 100% Silicone, no suspended partials.
    b. Architect to select final colors and locations during submittals phase.

2.3 CABINET HARDWARE

A. Five Knuckle Hinges:
1. Institutional (hospital tip), 5 knuckle, wrap around type with barrel only projecting beyond face of cabinet.
2. Use on cabinets unless noted otherwise.
3. Minimum Height: 2-3/4 IN.
4. Minimum 8 screws per hinge.
5. ANSI/BHMA-A156.9 Grade-1.
6. Hinge Quantities per leaf:
    a. For doors up to 48 IN high: 2 hinges.
    b. For doors over 48 IN high: 3 hinges.
7. Finish: 26D Dull Chrome.
8. Base Product: 370/450 series hinge by Rockford Process Control (RPC).

B. Drawer Slides:
1. Nylon wheels/rollers, stainless steel or polymer ball bearings, positive closing and pull out stops, drawer removable without use of tools.
2. Full extension.
3. Capacity:
    a. Standard Drawers (other than types listed below): 100 LBS.
    b. File Drawers: 150 LBS.
    c. Lateral Files:
        1) Less than 42 IN wide: 200 LBS.
        2) 42 to 48 IN wide: 400 LBS.
4. Optional Product:
    a. Metabox System by Blum, is acceptable where capacities (listed above) can be met.

C. Straight Wire Pulls:
1. 4 IN centers.
2. Finish: Satin stainless steel.

D. Catches:
1. Magnetic or roller type, adjustable.
2. Minimum 4 LB pull.
3. Provide two catches on doors more than 48 inches high.

E. Elbow Catch:
1. Provide at pairs of doors with locks.

F. Door Stops:
1. Metal slide type with positive stop.
2. Provide at locations where door opens adjacent to walls, cabinets and equipment.

G. Door Bumpers:
1. Provide on backside of doors and drawer faces.

H. File Hanging Rails:
1. Description: Full length metal suspension rails designed to support pendaflex hanging files.
2. Material: Powder coated steel to match drawer interior or mill finish aluminum.
3. Provide one pair of such rails at file drawers.

2.4 LOCKS

A. Keyed Locks:
1. Provide as confirmed by Owner.
2. Small pin tumbler with heavy duty deadbolt.

a. Disc tumbler type locks will not be accepted.
b. Cam locks will not be accepted.
3. Keyway: D4292, 5-pin.
4. ANSI/BHMA Standard: E07121.
a. Cycle Tested per ANSI/BHMA A156.11 Grade 1.
5. Base Products:
a. Door Locks: 100DR by Olympus Lock.
b. Drawer Locks: 200DW by Olympus Lock.
6. Finish: Satin Chrome US26D (BHMA 626).
7. Include spacers, adapters, fasteners and strikes.
8. Barrel Length: As appropriate for conditions.
9. Provide 2 keys for each lock.
10. Master key and grand master key as directed.
11. Provide 20 extra locks of each type; door locks and drawer locks to Owner at closeout.

2.5 SUPPORTS AND BRACKETS

A. Adjustable Shelf Supports:
1. Friction fit pins into cabinet end panels and vertical dividers.
2. Space 1/4 IN holes on 1 1/4 IN centers.
3. Locate support holes to avoid conflict with installation of hinges.
4. Retain shelves on support with spring clip shelf lock or screw attachment.
5. Material:
a. Injection molded clear polycarbonate.
6. Capacity: 200 LB minimum, per support device.

B. Metal Bracket for Cantilevered Countertop:
1. Material: 1/8 IN thick steel.
2. Pre-drilled for attachment to wall and countertop.
3. Include fasteners suitable for conditions.
4. Coordinate locations of blocking (see Section 09 22 16).
5. Capacity: 1000 LBS per bracket.
6. Base Product: 2424 AMH by Wizard Products.
7. Finish: Powder coat.
a. Color: To be selected by Architect.

2.6 MISCELLANEOUS CABINET HARDWARE

A. Grommets:
1. Base Product: XG-3 by Doug Mockett & Company, Inc.
2. Finish: Black or putty as selected by Architect.
3. Size: Provide 3-1/2 IN diameter flip top grommet cap with 7/8 IN x 1-3/8 IN cord slot.
4. Provide as directed by Owner after installation of equipment at each location such as, but not limited to, undercounter electrical or systems outlet, cord drops, and keyboard drawers.

2.7 FABRICATION

A. General:
1. See IC-Series Drawings for casework quantities, configurations, finishes, countertops and casework accessories.
2. Verify dimensions at site.
3. Verify locations of items furnished in other sections.
4. If necessary to vary from arrangement indicated because of structural, mechanical, electrical or other considerations, make such variations only after approval of Architect.

B. Definitions:
1. Exposed surfaces: Surfaces visible when doors and drawers are closed.
a. Door and drawer fronts, and their edges.
b. Exposed ends.

c. Bottom of wall case.
d. Countertop and backsplash and their exposed edges.
e. Face of cabinet body not covered by doors or drawer fronts.
f. Interior of open cabinets, including shelving.

2. Concealed surfaces: Surfaces not visible after installation.
   a. Solid top panels.
   b. Security panels.
   c. Locking rails.
3. Semi-exposed surfaces: Surfaces only visible when doors and drawers are opened.
   a. Interior of cabinets with opaque doors.
   b. Back sides of doors.
   c. Top of wall cabinets and tall cases.
   d. Drawer boxes.

C. Plastic Laminate Faced Casework:
1. Factory built casework finished on exterior with high pressure laminate.
2. Core Material:
   a. Medium Density Fiberboard (MDF).
   b. MR moisture resistant panels where work surfaces include a sink.
   c. MR panels shall have 50 percent reduction in thickness swell by ANSI A208.1.
3. Provide units complete with hardware, subbases and trim, in sizes and configurations indicated.
4. Style:
   a. Reveal overlay, with doors and drawer fronts overlapping case front with minimum reveal.
   b. Edge doors and drawer fronts with 3mm PVC banding, machine applied using waterproof hot melt adhesive. Machine profile exposed edges with 1/8 IN radius.
5. Finishes:
   a. Exposed surfaces: Plastic Laminate.
   b. Grain Direction, where laminate finish is directional: Vertical grain at frames, cases, door faces, drawer faces and other vertical surfaces.
   c. Semi-exposed surfaces: LPDL.
   d. Concealed surfaces: LPDL.
   e. Edges of Doors and Drawer Fronts: 3mm PVC edge banding.
   f. Edges of Case Body panels: 1mm PVC edge banding.
   g. Edges of Shelves: 1mm PVC edge banding (four sides).

D. Casework Components:
1. Case Body:
   a. Sides: 3/4 IN thick.
      1) Locate shelf support holes to avoid conflict with installation of door and drawer hardware.
   b. Top and Bottom Panels: 3/4 IN thick.
   c. Backs: 1/2 IN thick.
      1) Exception: Where back face is exposed to view: Upgrade to 3/4 IN.
   d. Security Panels: 1/2 IN thick.
   e. Drawer Lock Rails: 3/4 IN thick.
   f. Base: 3/4 IN thick, with intermediate reinforcing at 24 IN on center maximum.
2. Shelves:
   a. Less than 30 inches long: 3/4 IN thick.
   b. Between 30 and 40 inches long: 1 IN thick.
3. Doors:
   a. 3/4 IN thick.
   b. Doors not to exceed 25 IN in width.
4. Drawers:
   a. Drawer Fronts: 3/4 IN thick.

b. Sub-fronts, Sides and Backs: 1/2 IN thick.
c. Bottoms: 1/2 IN thick.
1) Include intermediate reinforcing rails where drawer width exceeds 18 IN.
5. Small Compartment Dividers: 1/4 IN clear acrylic panel.
6. Filler Panels and Scribe Pieces: 3/4 IN thick.
7. Soffits:
a. Material and finish to match cabinets.
b. 3/4 IN thick.
c. Abut soffit to acoustical tile ceiling without reveal or gap.
d. Cope tegular ceiling tile to overhang face of soffit.
e. Where distance between top of cabinet and ceiling is greater than 24 IN: Soffits to be sloped 30 degrees, unless noted otherwise.

E. Case Configuration:
1. Plastic Laminate Faced Units:
a. Provide reveal, approximately 1/8 IN, at top of doors and drawer fronts, and between doors and drawer fronts in same unit; reveal approximately 7/16 IN at sides.
2. Provide reveal 1/8 IN x 1/8 IN (black) in upper edge of exposed sides of wall case when plastic laminate soffits provided.
3. Toe space:
a. 4 IN high by approximately 3 IN deep; provide on front of each base unit unless noted on architectural drawings.
4. Countertop:
a. Plastic laminate units:
1) Overhang 3/4 IN beyond doors, drawer fronts and exposed ends.
5. Hardware mounting:
a. Drawers:
1) Center the pull in drawer front, horizontally.
2) No more than 4 IN from top.
b. Drawers with 2 pulls:
1) Set pulls at 1/4 points.
2) No more than 4 IN from top.
c. Swinging doors:
1) Set door pull in swing side corner, vertically, at top of base units; at bottom of wall units.
6. Adjustable shelves:
a. Use drilled hole supports only.
1) Depth: 1/2 IN less than inside cabinet depth.
2) Width: 1/8 IN, maximum, less than inside cabinet width.
7. Provide doors at locations requiring access to electrical devices, as indicated on drawings.

F. Joinery
1. Construct cabinet body of 3/4 IN thick core joined with 10mm diameter industrial grade hardwood dowels, securely glued and clamped under pressure during assembly.
2. Case body:
a. Sides, dividers, bottom, and top panels:
1) Minimum of 6 dowels at each joint for 24 IN deep cabinets.
2) Minimum of 4 dowels for 12 IN deep cabinets.
3) Glue joints.
b. Back:
1) For dadoed backs, dado into sides, bottom and top. Locate dado 3/4 IN in from back face of cabinet.
2) For on-set backs, rabbet at finished ends, screw at the top and bottom, staple at the sides.
3) Glue joints.
c. Compartment dividers and lock rails:

1) Dowel and glue.
d. Base:
1) Integral or separate.
2) Construct to receive base material to match adjacent walls, unless shown otherwise.
3) Blind fasten to bottom of case body when separate.
3. Drawers:
a. Sub-front, sides and back: Doweled and glued corner joints.
b. Bottom: Dado into 4 sides and glued or screwed to the bottom with the use of bottom supporting drawer slide hardware.
c. Front: Secured from sub-front side with no less than four screws.
d. Use no blocking or fasteners in exposed or semi-exposed locations.

G. Mechanical Fasteners:
1. Countertop joints:
a. Provide joint connectors every 6 IN OC.
2. Pre-drill and countersink screw holes before installation.
3. Do not use mechanical fasteners or blocking in exposed locations. When fasteners are required on exposed surfaces color, materials and finish to be approved by Architect.

2.8 COUNTERTOP MATERIALS AND FABRICATIONS

A. Plastic Laminate Faced Countertops:
1. General:
a. HPDL facing on exposed surfaces: 0.042 IN thick.
b. HPDL backer sheets on concealed surfaces: 0.020 IN thick.
c. Edges of raw fiberboard to be sealed with polyurethane before assembly.
d. Fabricator is responsible for matching patterns to produce an acceptable result.
2. Countertop Construction:
a. Core Material: Medium Density Fiberboard (MDF).
b. Core Thickness: 1-1/4 IN, or 3/4 IN with 1/2 IN build down.
c. Joints in counter length: Factory fitted, splined, glued, and mechanically fastened.
d. 2 IN radius on exposed outside corners.
e. Unless otherwise noted on the casework drawings, provide as noted in specifications.
3. Countertop front edges and exposed side edges:
a. Plastic Laminate Edge Banding: Apply laminate to front edge before top surface of countertop.
4. Backsplash: As indicated in the casework drawings.
5. Backsplash with scribe at top edge to be glued and secured to back edge of countertops where indicated.
a. Apply laminate to vertical face before top edge.
b. Apply backer sheet on back face.
c. Height: 4 IN or as indicated.
d. Cove radius 1/4 IN maximum.
6. Sidesplash: As indicated in the casework drawings.
a. Apply backer sheet on back face.
b. Apply laminate to vertical faces before top edge.
c. Provide laminate backer sheet on concealed surfaces before applying plastic laminate.
d. Secure to top and side wall.

B. Solid Surface Countertops (SSF): Specified in Section 12 36 63.

2.9 WINDOW SILL MATERIALS AND FABRICATIONS

A. Solid Surface Window Sills (SSF): Specified in Section 12 36 63.

PART 3 - EXECUTION

3.1 INSPECTION

A. Verify suitability of substrate to accept installation.

B. Ensure that adequate Wall Backing has been installed.
   1. Metal Wall Backing: Specified in Section 09 22 16.
   2. Coordinate and direct installation of backing where required.

C. Correct unsatisfactory conditions.

D. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. Use manufacturer's printed instructions or drawings in cases where items or details are not indicated.

B. Hardware:
   1. Install hinges, stops, guides and other door and drawer hardware to avoid adjustable shelf holes in case body.

C. Construct units with sinks or lavatories to withstand an applied vertical load of not less than 250 pounds on the front edge of countertop.

D. Provide cutouts for mechanical and electrical items.

E. Seal sink cutouts.

F. Install up to 10 extra door locks and 10 extra drawer locks in casework not previously shown or scheduled to have locks.
   1. Install extra locks where directed by Owner.
   2. Closeout: Turn over any extra uninstalled locks to Owner.

3.3 SEALING OF JOINTS

A. Seal casework, countertops and splashes to walls, to seal joints.
   1. Sealant color to match countertop color.

B. Seal perimeter of counter mounted sink fixtures.
   1. Sealant color to match countertop or sink color.

C. Seal window sills to walls and window frames to seal joints.
   1. Sealant color to match color of sill material specified.

3.4 ADJUSTMENTS AND CLEANING

A. Test and adjust items of equipment for satisfactory operation.

B. Adjust hinges for proper door alignment.

C. Adjust drawer guides for proper drawer front alignment and operation.

D. Adjust countertops to a level position and align to adjacent unit.

E. Repair damage to casework or countertops to appear in original new condition.

F. Repair damage to premises as a result of installation.

G. Remove debris left by this installation.

H. Clean casework and countertops after above items have been completed.

END OF SECTION

SECTION 12 36 43
GRANITE COUNTERTOPS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Granite Countertops, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Installer Qualifications:
   1. An installer who employs experienced mechanics and stone fitters who are skilled in installing stone countertops similar in material, design, and extent to those indicated.
   2. Successful completion of similar projects.

B. Fabricator Qualifications:
   1. Shop that employs skilled workers who fabricate stone work similar to those indicated for this Project and whose products have a record of successful in-service performance.

C. Source Limitations for Stone:
   1. Obtain each variety of stone, regardless of finish, from a single quarry with resources to provide materials of consistent quality in appearance and physical properties.

D. Source Limitations for Other Materials:
   1. Obtain each type of setting materials, stone accessories, sealants, and other material from a single manufacturer.

E. ASTM International (ASTM):
   1. ASTM C97 Standard Test Method for Absorption and Bulk Specific Gravity of Dimension Stone
   2. ASTM C99 Standard Test Method for Modulus of Rupture of Dimension Stone
   3. ASTM C170 Standard Test Method for Compressive Strength of Dimension Stone
   4. ASTM C241 Standard Test Method for Abrasion Resistance of Stone Subjected to Foot Traffic
   5. ASTM C295 Standard Guide for Petrographic Examination of Aggregates for Concrete
   6. ASTM C880 Standard Test Method for Flexural Strength of Dimension Stone
   7. ASTM C1353 Standard Test Method for Abrasion Resistance of Dimension Stone Subjected to Foot Traffic Using a Rotary Platform, Double-Head Abraser

F. Test Sealants and other materials coming in contact with Limestone for compatibility.

G. Stone Abrasion Resistance:
   a. Minimum value of 12 when tested per ASTM C241 or ASTM C1353, unless a higher value required by building stone standards referenced.

H. Marble Institute of America (MIA), document:
   1. Residential Stone Countertop Installation

1.3 SUBMITTALS

A. Shop Drawings:
   1. Include plans, elevations, sections, and details.
   2. Base piece sizes on field-verified dimensions.

B. Product Data:
   1. Each variety of stone.
   2. Include data on physical properties required by referenced ASTM standards.

3. Stone accessories and other manufactured products.

C. Samples:
1. Stone samples for each stone type indicated:
a. Size: 12 x 12 IN.
b. Quantity as required to illustrate full range of variations in appearance characteristics.
2. Joint material samples for color selection.
3. Sealant colors for selection.

D. Project Information:
1. Fabricator Qualifications.
2. Installer Qualifications.

E. Contract Closeout Information:
1. Certificates.
2. Maintenance Data
a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fabricated Granite Slabs:
1. Base:
a. See Sheet I-001.

B. Setting Materials:
1. Base:
a. Laticrete International.
2. Optional:
a. Boiardi Products Corp.
b. Bostik.
c. Custom Building Products.
d. Mapei.
e. TEC Specialty Products Inc.
3. Mortar Pigments (for cement based grouts):

C. Stone Sealers:
1. Base:
a. Bostik.
2. Optional:
a. Custom Building Products.
b. Hillyard.
c. HMK Stone Care Products.
d. Miracle Sealants Company.
e. Stone Care International.
f. Summitville Tiles, Inc.

D. Sealants:
1. Base:
a. See Section 07 92 16.

E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
1. Stone variety and source:
a. Subject to compliance with requirements specified, provide the stone type listed in Stone Types Article.

2. Where stone has 2 or more different finishes on same stone type: Provide stone of same variety and from same source.
3. Provide stone from a single quarry for each stone type specified
4. Quarry stone in a manner to ensure that as-quarried block orientations yield finished stone with required characteristics.
5. Provide stone that is free of cracks, seams, and starts impairing structural integrity or function.
6. Provide granite complying with ASTM-C615 and NBGQA's "Specifications for Architectural Granite".

B. Granite Type GF-1:
1. See Sheet I-001.
2. Minimum Physical properties of Granite Type GF-1:

Minimum Physical Properties Granite Type GF-1		
Property	**Test Method**	**Required Value**
Absorption by weight (max)	ASTM C97	0.40 percent
Density (min)	ASTM C97	160 PCF
Compressive Strength (min)	ASTM C170	>19,000 PSI
Modulus of Rupture (min)	ASTM C99	>1500 PSI
Flexural Strength (min)	ASTM C880	>1200 PSI
Abrasion Resistance (min)	ASTM C241	Ha=25.0

2.3 SETTING MATERIALS

A. General:
1. Non-staining, bonding material used to bring stone to level, transfer loads to substrate evenly, and prevent subsequent movement.

B. Setting Material:
1. Cement based or chemical adhesive based materials as appropriate to conditions.

C. Accessory Materials:
1. Shims to be rigid, non-staining, non-reactive plastic, hardwood, or stainless steel.

2.4 GRANITE JOINT MATERIALS

A. General:
1. Color to match stone materials being joined.

B. Joint Material:
1. Colored Epoxy.

C. Portland Cement-based Grout.
1. Compose pigments of natural or synthetic iron oxides, compounded for use in mortar mixes.
2. Pigments shall not exceed 10 percent portland cement by weight.

D. Sealant:
1. Description:
   a. Silicone.
2. Colors:
   a. Colors to match materials being caulked.

E. Spacers:
1. Resilient plastic, non-staining to stone, sized to suit joint thicknesses.

F. Cleaner:
   1. Stone cleaner specifically formulated for stone types, finishes, and applications indicated, as recommended by stone producer.
   2. Do not use cleaning compounds containing acids, caustics, harsh fillers, or abrasives.

G. Stone Sealer:
   1. Colorless, slip and stain resistant sealer that does not affect color or physical properties of stone surfaces, as recommended by stone producer for application indicated.

H. Sealant:
   1. For use to seal granite to dissimilar materials such as walls, sinks and other plumbing fixtures.
   2. Description:
      a. Silicone.
      b. See Section 07 92 16.
   3. Color:
      a. Colors as required to match various granite colors specified.

2.5 STONE FABRICATION

A. General:
   1. Comply with recommendations in MIA (Marble Institute of America) “Dimension Stone Design Manual” and NBGQA’s "Specifications for Architectural Granite.”
   2. Fabricate stone in sizes and shapes necessary to comply with requirements indicated.
   3. Cut stone to produce pieces of thickness, size, and shape indicated and to comply with fabrication and construction tolerances recommended by applicable stone association.
   4. Clean sawed backs of stones to remove rust stains and iron particles.
   5. Carefully inspect finished stone units at fabrication plant for compliance with requirements for appearance, material, and fabrication.
      a. Replace defective units.
      b. Grade and mark stone for overall uniform appearance when assembled in place.
      c. Natural variations in appearance are acceptable if installed stone units match range of colors and other appearance characteristics represented in approved samples.
   6. Laminate units where required to attain the profiles indicated.

B. Lay-out and Slab Selection:
   1. Layout slabs prior to cutting to ensure that:
      a. Markings, veins, and particularities of individual slabs are within the tolerance range of approved samples.
      b. Acceptable markings (if any) are oriented uniformly.
      c. Slabs are consecutive from the block.
      d. Slabs are flat, free of warp.

C. Material Thickness; Provide thickness indicated, but not less than:
   1. 1-1/8 IN.
   2. Or Thickness as indicated on Drawings.
   3. General:
      a. Fabricate to profile indicated.
      b. Prior to machining: Laminate edges where increased thickness is indicated.
         1) Utilize epoxy and stainless steel pins.
         2) Stone to stone joints to be tight and free of spalls.

D. Stone to Stone Joints:
   1. Abutting stone pieces must be free of chips, spalls, cracks and other defects.
   2. Fabricate with light arris.
   3. Utilize slots and stainless steel biscuits/splines where necessary to ensure alignment of finished surfaces.

4. Cut stone to produce uniform joints of the following dimension:
    a. Nominal Joint Width:
        1) Horizontal to Horizontal: 1/16.
        2) Horizontal to Vertical: 1/16.
        3) Vertical to Vertical: 1/16.
5. Placement of joints:
    a. Locate piece to piece joints in accordance with MIA recommendations.
    b. Indicate proposed locations on Shop Drawings for Architect approval.

E. Gap between Stone and abutting wall:
1. Where splashes will be installed:
    a. Nominal Joint Width: 1/8 IN to half the thickness of the splash material.
2. Where no splashes will be installed:
    a. Nominal Joint Width: 1/8 IN.
    b. Scribe stone as required to fit wall irregularities.

F. Cut-outs:
1. Comply with MIA details as appropriate for fixtures to be installed in cut-out.
2. Reinforce opening as required to safely carry the fixture loads and to compensate for cut-out.

G. Slab Reinforcement:
1. Reinforce granite countertops at sink cutouts and other locations as determined by fabricator/installer.
2. Apply steel rods and/or woven glass mesh to bottom surface of countertops, or
3. Embed with epoxy or polyester resin.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces indicated to receive stone, with Installer present, for compliance with requirements for maximum moisture content, installation tolerances, and other conditions affecting performance.
1. Notify Architect in writing, listing conditions detrimental to performance of stone work.
2. Proceed with installation only after unsatisfactory conditions have been corrected.

B. Field Measurements:
1. Obtain field measurements prior to final fabrication of pieces.
2. Obtain measurements and exact locations of sinks, appliances, electrical devices, and other items requiring cutouts.

C. Substrate Quality:
1. Inspect substrate to ensure that it has been built true to plane and level within 1/8 IN in 10 FT.
2. Ensure that substrate is stable, rigid and capable of supporting weight of granite.
    a. Reinforce as required.
3. Ensure that underlayment, where used, is moisture resistant.

3.2 PREPARATION

A. Vacuum clean or sweep concrete substrates to remove dirt, dust, debris, and loose particles.

B. Remove substances from substrates that could impair bond.

C. Clean dirty or stained stone surfaces by removing soil, stains, and foreign materials before setting.
1. Clean stone by thoroughly scrubbing with fiber brushes and then drenching with clear water.
2. Use only mild cleaning compounds that contain no caustic or harsh materials or abrasives.

3.3 INSTALLATION

A. General:
   1. Comply with MIA (Marble Institute of America) document: Residential Stone Countertop Installation.

B. Units with sinks or lavatories shall withstand an applied vertical load of not less than 113.4 kilograms 250 pounds on front edge of countertop.

C. Countertop Installation:
   1. Test fit slabs and shim into place.
      a. Ensure that specified tolerances are achievable.
      b. Perform field machining as required.
         1) Use power tools with diamond blades to cut stone.
      c. Scribe and field-cut stone as necessary to fit at obstructions.
         1) Produce tight and neat joints.
   2. Adhere Countertops to Substrate:
      a. Remove slabs and apply setting material.
      b. Dry stone.
      c. Reset slabs and re-check for fit.
      d. Adjust as appropriate, with in open-time limits of setting material.
   3. Install Joint Filler:
      a. Thoroughly clean and dry stone top surface.
      b. Mask joints to ensure that excess filler will not damage cabinets and finishes below.
      c. Mix filler per manufacturer's instructions and fill joints full and flush.
      d. Remove excess material before it is completely cured.
      e. When cured, polish epoxy filler by sanding across the joint with 00 or 000 grade steel wool.
         1) Remove all high spots and create a uniform, shiny joint.

D. Installation of Backsplashes and Sidesplashes:
   1. Pre-assemble splashes for fit.
   2. Shim to 1/16 above countertops.
   3. Perform field machining as required.
   4. Adhere into place.
   5. Fill joints as described for countertops.

3.4 INSTALLATION TOLERANCES

A. Length and Width: Plus or Minus 1/8 IN.

B. Deviation from Square:
   1. Pieces with largest dimension less than 39 IN: Plus or Minus 1/16 IN.
   2. Pieces with largest dimension greater than 39 IN: Plus or Minus 1/8 IN.

C. Flatness: Not more than 1/16 IN in 4 FT any length.

D. Variation in Plane between Adjacent Units (Lipping):
   1. Do not exceed 1/32 IN difference between planes of adjacent units.

3.5 CAULKING

A. Caulk countertops and splashes to walls.
   1. Caulk color to match countertop color.

B. Seal perimeter of counter-mounted sink fixtures.
   1. Sealant color to match countertop or sink color.

3.6 ADJUSTING AND CLEANING

A. Remove and replace stone work of the following description:
   1. Broken, chipped, stained, or otherwise damaged stone.

a. Stone may be repaired if methods and results are approved by Architect.
2. Defective joints.
3. Stone pieces and joints not matching approved samples.
4. Stone pieces not complying with other requirements indicated.
5. Replace in a manner that results in stone countertops matching approved samples, complying with other requirements, and showing no evidence of replacement.

B. In-Progress Cleaning:
1. Clean stone as work progresses.

C. Clean stone after setting and joint filling are complete.
1. Use procedures recommended by stone fabricator for types of application.

D. Apply sealer to cleaned stone work according to sealer manufacturer's written instructions.

3.7 PROTECTION

A. Protect stone during construction with breathable, non-staining material.

END OF SECTION

SECTION 12 36 63
SOLID SURFACE FABRICATIONS (SSF)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Solid Surface Fabrications, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Applicable standards:
   1. International Association of Plumbing and Mechanical Officials (IAPMO)
      a. IAPMO Z124 Plastic Plumbing Fixtures.
   2. ASTM International:
   3. National Electrical Manufacturers Association (NEMA).
      a. NSF International.
         1) NSF/ANSI Standard 51 for food zone - all food types.
   4. Manufacturer's certification of fabricator and installer.

B. Fabricator and Installer Qualifications:
   1. Firm that employs skilled workers who custom fabricate products similar to those required for this project and whose products have a record of successful in-service performance.

C. Manufacturer Certification of Fabricator and Installer:
   1. Certified by manufacturer.
   2. Submit prior to Shop Drawings.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Show location of each item, dimensioned plans and elevations, large-scale details, attachment devices and other components.
   2. Show full-size details, edge details, thermoforming requirements, attachments, etc.
   3. Show locations and sizes of furring, blocking, including concealed blocking and reinforcement.
   4. Show locations and sizes of cutouts and holes for plumbing fixtures, faucets, soap dispensers, waste receptacle and other items installed in surface.
   5. Indicate dimensions, component sizes, fabrication details, attachment provisions and coordination requirements with adjacent work.

B. Product Data:
   1. Manufacturer's product data sheets, details and installation instructions for Solid Surface Fabrications, components and accessories.

C. Samples:
   1. For each SSF color selected:
      a. Minimum 6 IN x 6 IN sample in specified gloss.
      b. Cut sample and seam together for representation of inconspicuous seam.
      c. Indicate full range of color and pattern variation.
   2. Sealant colors for selection.
   3. Approved samples will be retained as a standard for work.

D. Project Information:
   1. Manufacturer's current certification of Fabricator and Installer prior to submittal of Shop Drawings.

E. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data.
      a. See Section 01 78 23.

1.4 WARRANTY

A. Provide ten (10) year manufacturer's warranty including colorfastness and material defects.
   1. Warranty shall provide material and labor to repair or replace defective materials.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Solid Surface Fabrications (SSF):
   1. Base:
      a. Corian by DuPont.
   2. Optional:

B. Sealant:
   1. Base:
      a. Color Rite.
   2. Optional:
      a. As approved by SSF manufacturer.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Solid Surface Materials:
   1. Cast, non-porous, homogeneous, acrylic polymer composition with additional fire retardant fillers and pigments.
      a. Prime product may not coated, laminated of composite construction.
   2. Defects with depth < 0.010 IN shall be considered superficial.
      a. Repair superficial damage by sanding and/or polishing.
      b. Components with more severe defects shall be rejected.
   3. Physical properties:

Minimum Physical Properties		
Property	**Method**	**Value**
Tensile Strength	ASTM D638	5500 PSI
Flexural Strength	ASTM D790	10 KSI
Hardness	Rockwell M Scale ASTM D785	>85
	Barcol Impressor ASTM D2583	55
Thermal Expansion	ASTM D696	1.8 x 10-5 IN/IN/DegF
Gloss (60 –degree Gardner)	IAPMO Z124	Matte = 5; Highly Polished = 75
Light Resistance	NEMA LD 3-2000 Method 3.3	No Effect (Xenon Arc)
Wear and Cleanability	IAPMO Z124	Pass
Stain Resistance	IAPMO Z124	Pass
Fungal Resistance	ASTM G21	Does not support growth
High Temperature Resistance	NEMA LD 3-2000 Method 3.6	No change
Boiling Water Resistance	NEMA LD 3-2000 Method 3.5	No visible change
Ball Impact Resistance; 1/2 LBS Ball	NEMA LD 3-2000 Method 3.5	36 IN drop ¼ IN sheet
		144 IN drop ½ IN sheet

Minimum Physical Properties (Cont.)		
Property	**Method**	**Value**
Water Absorption	ASTM D570	0.8% for ¼ IN sheet
		0.6% for ½ IN sheet
Flammability	ASTM E84 and NFPA 255	Class I / Class A
Flame Spread Index		< 25
Smoked Developed Index		<450

B. Backing materials (build down):
   1. Finished or exposed edges: SSF material.
      a. Profiles as indicated.
   2. Concealed spaces and non exposed edges:
      a. Moisture-resistant medium-density fiberboard (MDF) Panels or moisture-resistant plywood.
      b. Physical Properties, Based on 3/4 IN Thickness, ASTM D1037, Part A:
         1) Density: 48 LBS/FT3.
         2) Modulus of Rupture: 4,500 PSI.
         3) Screw Holding: Required to pull 1 IN #10 sheet metal screw:
            a) Face: 230 LBS.
            b) Edge: 185 LBS.
         4) Water Absorption: 14 percent average, 24 hour soak.
         5) Thickness Swell: 6 percent average, 24 hour soak.
         6) Flame Spread Rating, ASTM E84: Class A (1).
      c. Panel Thickness:
         1) As required for application, utilize a single thickness to achieve build down to cross sectional thickness.
   3. Backer Sheets for knee spaces:
      a. Backer sheet: Grade-BK20, 0.020 IN thick.
      b. Apply to bottom side of backing material.
   4. Backing materials adhesive:
      a. Construction grade adhesive recommended by SSF manufacturer for backing materials with VOC content no greater than 70 g/L.

C. Joint Adhesive:
   1. Manufacturer's standard one- or two-part adhesive as required for inconspicuous, non-porous joint with VOC content no greater than 80 g/L.

D. Sealant:
   1. Elastomeric.
   2. Mildew-resistant, FDA-compliant, NSF 51-compliant (food zone - any type), UL-listed silicone sealant in colors matching components.
   3. Specifically formulated for applications indicated, including wet areas.
   4. Elastomeric.
   5. Shore A Hardness: 25.
   6. Compatible with SSF specified.
   7. Compatible with gypsum wallboard, paint, laminates and other materials being sealed.
   8. Sealant VOC content shall be no greater than 250g/L.
   9. Colors:
      a. Colors to match specified SSF colors from no less than 400 standard color choices.
      b. Number of different colors required for project shall not be limited.
   10. Base Products:
      a. Where solid colored SSF: Color-Sil by Color Rite; 100 percent silicone, uniformly colored, no suspended accent color partials.
      b. Where speckle-colored SSF is specified: Poly-Sil by Color Rite; 100 percent silicone with suspended accent color particles.

c. Architect to select final colors and locations during submittals phase.

E. Conductive Foil Tape:
1. Manufacturer's standard aluminum foil tape, with required thickness, for use with cutouts near heat sources.

F. Insulating Felt Tape:
1. Manufacturer's standard for use with conductive tape in insulating solid surface material from adjacent heat source.

2.3 SHOP FABRICATION - GENERAL

A. Shop Assembly
1. Fabricate components to greatest extent practical to sizes and shapes indicated, in accordance with approved shop drawings and manufacturer's instructions.
2. Form joints between components using color-matched Joint Adhesive in an inconspicuous manner.
   a. Reinforce with 4 IN wide strip of SSF material.
3. Provide factory cutouts for plumbing fittings and bath accessories as indicated.
   a. Radius inside corners of cutouts as large as but not less than 1/4 IN.
   b. Reinforce with SSF corner blocks to avoid stress cracking.
   c. Sand edges and corners smooth and free of chips or nicks.
   d. Utilize heat-conductive aluminum tape around drop-in stoves and other heat sources to protect SSF from thermal stress.
4. Rout and finish component edges with clean, sharp returns.
   a. Rout cutouts, radii and contours to template.
   b. Smooth edges.
   c. Repair or reject defective and inaccurate work.
5. Fabricate coved splashes where indicated.
6. Reinforce inside corners, narrow pieces, cantilevered overhangs, and stress points against breakage by laminating an additional thickness of SSF on concealed face.
7. Laminate additional thicknesses of SSF and tool edge profiles indicated.
8. Uniformly finish completed pieces according to SSF schedule.

2.4 FABRICATIONS

A. SSF Window Sills:
1. Configurations detailed on Architectural Drawings.
2. Thickness: Minimum 1/2 IN (unless otherwise indicated).
3. Join multiple pieces, where required, with Joint Adhesive to create inconspicuous seam.
4. Edge Treatments: As indicated on the drawings.
5. Polish exposed faces.
6. SSF Color / Pattern / Finish: SSF-1.

B. SSF Wall Caps, Niches and Similar Decorative Uses:
1. Configurations detailed on Architectural Drawings.
2. Thickness: Minimum 1/2 IN, unless otherwise indicated.
3. Join multiple pieces, where required, with joint adhesive to create inconspicuous seam.
4. Edge treatments: As indicated on the drawings.
5. Polish exposed faces.
6. SSF color / pattern / finish: SSF-1.

C. SSF Countertops:
1. Configurations as indicated on the IC-series Drawings.
2. Composite thickness of countertop assemblies: 1-1/4 IN unless otherwise indicated.
   a. Nominal Thickness of SSF material: Minimum 1/2 IN unless otherwise indicated.
3. Radius exposed outside corners: Minimum 1-1/2 IN.
4. Join multiple pieces, where required, with Joint Adhesive to create inconspicuous seam.
5. Backer:

a. Configure backing material as required for application:
b. Ladder frame at SSF countertops supported by base cabinets:
   1) Form ladders from approved backing material ripped into 3- 4 IN wide strips.
   2) Locate main runner strips (rails) along front and back edges of countertops.
      a) Provide clearance for shrinkage and normal expansion and contraction.
   3) Space front-to-back supports (stiles) to align with line where base cabinet units adjoin. Locate stiles over other wall brackets and supports.
   4) Where base cabinets and supports exceed in 24 IN width: Include additional intermediate stiles so that maximum spacing does not exceed 24 IN.
   5) Provide additional intermediate stiles at seams in SSF countertop material.
   6) Join the stiles to rails using screwed or glued wooden biscuit seams, serrated dowels or rabbeted seams.
   7) Overhangs: Configure backer material per SSF manufacturer's guidelines according to amount of overhang projects past its support.
c. Countertops which span between supports 30 IN and wider:
   1) Fabricate backer from solid backing material (not stile and rail construction).
   2) Extend one-piece, solid backer material, across entire span. Extend load bearing edges not less than 4 IN over edge of supporting cabinets (or similar support).
d. Portions of Countertops schedule to support countertop equipment:
   1) Provide full backing for the entire countertop cross section for the full width of the equipment.
   2) Extend 4 IN (min) beyond equipment width and as required for mounting.

6. Backsplashes and Sidesplashes:
   a. Provide where indicated.
   b. Thickness: Minimum 1/2 IN (unless otherwise indicated).
   c. Height: As indicated.
   d. Fabricate from same material and color as top.
   e. Backsplash Style: Integrally-coved.
   f. Sidesplash Style: Applied.
7. Front overhang of Tops: 1-1/2 IN, unless otherwise indicated.
8. Edge Treatments: As indicated on the drawings.
9. Polish exposed faces.
10. SSF color / pattern / finish: SSF-1.

D. Integral SSF Sinks:
   1. Material: Cast, homogenous material composed of polyester and acrylic resins, fire-retardant filler materials, and coloring agents.
   2. Shapes complying with IAPMO Z124 standards for plastic sinks and lavatories.
   3. Mounting: Seamed under-mount.
   4. Mounting hardware: Manufacturer's standard bowl clips, panel inserts and fasteners for attachment of undermount sinks/lavatories.
   5. Provide bowl size and depth as indicated on IC-series elevations and Sheet I-001.
   6. Color: Cameo White.

E. Sinks (specified elsewhere):
   1. Porcelain, enameled steel and/or stainless steel bowls: Specified in Section 22 42 00.

F. Faucets and Trim: Specified in Section 22 42 00.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates and conditions, with fabricator present, for compliance with requirements for installation tolerances and other conditions affecting performance of work.
   1. Verify measurements, dimensions and drawing details before proceeding.

2. Coordinate location of furring, nailers, blocking, grounds and similar supports for attached work.
3. Examine conditions under which work is to be installed.
4. Correct unsatisfactory conditions.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

C. Installation constitutes acceptance of responsibility for performance.

3.2 INSTALLATION

A. General:
1. Install components plumb, level and rigid, scribed to adjacent finishes, in accordance with approved shop drawings and product data.
2. Provide product in the largest pieces available.
3. Form field joints using manufacturer's recommended adhesive, with joints inconspicuous in finished work.
   a. Exposed joints/seams will not be allowed.
4. Reinforce field joints with SSF strips extending a minimum of 1 to 2 IN on either side of the seam with the strip being the same thickness as the top.
5. Cut and finish component edges with clean, sharp returns.
6. Rout radii and contours to template.
7. Anchor securely to base cabinets or other supports.
8. Align adjacent countertops and form seams to comply with manufacturer's written recommendations using adhesive in color to match countertop.
9. Carefully dress joints smooth, remove surface scratches and clean entire surface.
10. Install countertops with no more than 1/8 IN sag, bow or other variation from a straight line.
11. Units with sinks or lavatories shall withstand an applied vertical load of not less than 250 LBS on front edge of countertop.

B. Window Sills (stools):
1. Shim as required so that installed items are plumb, true and level.
2. Install Window Sills full length of window, set securely into place using only concealed fasteners and approved adhesive.
3. Adhere sills to substrate with dabs of a clear silicone sealant at 10 to 12 IN intervals.
4. Where sills are abutted by walls at both ends: Allow 1/8 IN expansion gaps at both ends for every of 10 FT sill.
   a. Seal gaps with elastomeric sealant.
5. Ease edges and sand smooth.

C. Countertops:
1. Install plumb, level, true and straight.
   a. Shim as necessary using concealed shims.
2. Adhere tops to base cabinets with dabs of a clear silicone sealant at 10 to 12 IN apart.
3. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
   a. Supply additional wood supports, spaced no more than 18 IN apart or as otherwise required for adequate strength.
4. Attach top securely to base unit or support brackets in accordance with manufacturer's instructions.
   a. Ensure full contact with support brackets and backing for entire support length with mechanical fastening into backing material.
   b. Provide fasteners of appropriate length. Do not allow screws to penetrate into SSF material.
   c. Supply additional supports or solid backing as required for adequate strength.
5. Where tops are abutted by walls at both ends:
   a. Include 1/8 IN expansion gaps at both ends for every of 10 FT countertop.
   b. Seal gaps with elastomeric sealant.

D. Backsplashes and Sidesplashes:
   1. Integrally Coved Splashes:
      a. Join coved items to countertops using color-matched Joint Adhesive.
      b. Adhere to walls and other substrates with clear silicone sealant.
      c. Seal to walls and adjacent cabinets with color-matched, elastomeric sealant.
   2. Applied Splashes:
      a. Join adhered items to substrate using color-matched, elastomeric sealant.
      b. Adhere to walls and other substrates with clear silicone sealant.
      c. Seal to walls and adjacent cabinets with color-matched, elastomeric sealant.

E. Integral SSF Sinks:
   1. Install SSF sink (or lavatory) bowls with overflows in locations shown on the drawings.
   2. Secure bowls to tops using Joint Adhesive and mounting hardware to maintain warranty.
   3. Drain and overflow connections: Specified in Section 22 42 00.

F. Sinks:
   1. Install sinks per Section 22 42 00.
   2. Seal to Countertop with elastomeric sealant and mounting hardware provided.
   3. Drain and overflow connections: Specified in Section 22 42 00.

G. Faucets and Trim:
   1. Install faucets and trim per Section 22 42 00.
   2. Plumbing connections: Specified in Section 22 42 00.
   3. Seal to Countertop with elastomeric sealant.

3.3 CLEANING AND PROTECTION

A. Keep components clean during installation.

B. Protect finished surfaces from damage.

C. Remove adhesives, sealants and other stains.

3.4 REPAIR

A. Repair damaged work.

B. Replace damaged work which cannot be repaired to Architect’s satisfaction.

END OF SECTION

SECTION 12 48 26
NYLON ENTRANCE TILE (NET)

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Nylon Entrance Tile (NET) in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer Qualifications:
   1. Carpet manufacturer with no less than ten (10) years of production experience with carpet similar to type specified.

B. Installer Qualifications:
   1. Firm with not less than five (5) years experience similar to work of this section and recommended and approved by the carpet manufacturer.

1.3 SUBMITTALS

A. Samples:
   1. Three samples 12 IN square of each material and color specified in Drawing I-001 Interior Notes & Finish Legend.

B. Contract Closeout Information:
   1. Warranty.
   2. Maintenance data.
      a. See Section 01 78 23.

1.4 WARRANTY

A. Ten (10) year warranty signed jointly by manufacturer and installer, agreeing to repair or replace failed work performed under this section.
   1. Failure includes but not limited to:
      a. Defects in materials, workmanship,
      b. Manufacturing defects:
         1) Dimensional stability.
         2) Delamination.
      c. Damaged tiles.
      d. Tile stained by adhesives.
      e. Tiles showing excessive wear.
         1) Excessive wear is defined as wearing away of face yarns which reduces pile height by more than 10 percent in any area or pulling out of nap.
   2. Warrant cost of replacement, including removal, replacement, and disposal of defective tiles.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Nylon Entrance Tile (NET):
   1. Base:
      a. As noted for individual types under Carpet Types on Sheet I-001 Interior Notes and Finish Legend.

B. Tile Edging:
   1. Base:
      a. BurkeMercer.

C. Adhesives:
   1. Base:
      a. 3M.

D. Sealer:
   1. Base:
      a. L&M Construction Chemicals.

E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Nylon Entrance Tile:
   1. First quality, no seconds or imperfects.
   2. Deliver with mill register numbers attached.
   3. Comply with applicable state and local codes.

B. Carpet Edging:
   1. Type:
      a. BurkeMercer _____.
   2. Thickness to match carpet.
   3. Color as selected by Architect.

C. Adhesive:
   1. Non-staining, non-bleeding strippable type as recommended by tile manufacturer.

D. Sealer:
   1. Water based acrylic cure/sealer.
   2. L&M Construction Chemicals, Lumiseal FX.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Verify suitability of substrate to accept installation,

B. Verify concrete floor surfaces are suitable for Nylon Entrance Tile installation.
   1. Coordinate installation with requirements of Section 07 16 04 Concrete Floor Moisture Testing, and Section 07 16 05 Water Vapor Emission Control System.

3.2 PREPARATION

A. Clean all areas to receive tile.
   1. Seal new concrete.

B. Remove dust and vacuum, damp mop and seal concrete.

C. Fill cracks, joints, holes or uneven areas with non-crumbling manufacturer approved latex base floor filler.

D. Test for open-time bond before commencing work.

3.3 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Arrange joints symmetrically about centerline of space.

C. Comply with manufacturer's recommendations for uniformity of direction and lay of carpet pile.

D. Butt edges to produce tightest joint possible without distortion.

E. Provide cut outs where required.
   1. Make clean cuts in accordance with manufacturer's recommendation.
   2. Conceal cut edges with protective edge guards or overlapping flanges.

F. Install tight against walls, columns and door floor closers.

G. Install edge guard at openings and doors wherever carpet terminates, unless indicated otherwise.

H. Where tiles abut thicker finish flooring materials, feather leveling compound for approximately 12 IN for each 1/8 IN of rise until finished surfaces align.

I. Expansion Joints:
   1. Do not bridge building expansion joints with continuous carpeting.
   2. Allow for movement.

J. Adhesive:
   1. Install in accordance with manufacturer's instructions.
   2. Adhesive must have recommended flash time before carpet is positioned.
   3. Do not mix dye lots in same area.

K. Install carpet edging strips, transition strips, reducer strips, at non-carpeted floor surface.
   1. Install with contact adhesive.
   2. Score and trim narrow end of reducer strip to conform to adjacent floor finish.

3.4 CLEAN

A. Remove adhesive from face or seam using products recommended by manufacturer.

B. Vacuum using pile lifter.

C. Advise Owner regarding care and maintenance.

3.5 PROTECTION

A. Protect with nonstaining building material paper runners or approved material.

B. Protect installation from rolling traffic with sheets of hardboard or plywood.

C. Maintain protection until accepted.

3.6 INSPECTION

A. Inspect installation and verify work is complete, properly installed, and acceptable.

B. Remove and replace work not found acceptable.

END OF SECTION

DIVISION 14

CONVEYING EQUIPMENT

SECTION 14 42 27
COURTROOM WHEELCHAIR LIFT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Courtroom Wheelchair Lifts, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades, including surrounding construction and courtroom millwork.

1.2 REFERENCES

A. 2010 ADA Standards for Accessible Design.

B. ASME A18.1 Safety Standard for Platform Lifts and Stairway Chairlifts.

1.3 SUBMITTALS

A. Product Data: Submit five copies of manufacturer's technical data, operating and service instructions for Courtroom Wheelchair Lifts.

B. Samples: Submit color samples for selection by the Architect.

C. Shop Drawings:
   1. Submit one set of reproducibles and four sets of prints of all shop drawings for equipment installation, indicating field dimensions affecting installation. Show equipment in detail including method of installation, anchorages and finishes.
   2. Show dimensions and locations of all items including attachments to supporting structure required.

1.4 CLOSEOUT SUBMITTALS

A. Approvals from authorities having jurisdiction.

B. Operations and Maintenance Manuals.

1.5 QUALITY ASSURANCE

A. Comply with ASME A18.1 Standard for lifts in public installations.

B. Installers Qualifications: A company regularly engaged in the business of manufacturing, installing and serving wheelchair lifts of the type specified for at least five(5) years, and with a history of successful installations acceptable to the Architect.

C. Uniformity: All equipment and accessories within this section shall be produced by a single manufacturer, including necessary controls, fittings, and fastenings.

1.6 DELIVERY, STORAGE AND HANDLING

A. Store products in manufacturer's unopened packaging until ready for installation.

B. Store and dispose of solvent-based materials, and materials used with solvent-based materials, in accordance with requirements of local authorities having jurisdiction.

1.7 FIELD CONDITIONS

A. Maintain environmental conditions (temperature, humidity, and ventilation) within limits recommended by manufacturer for optimal results. Do not install products under environmental conditions outside manufacturer's absolute limits.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Courtroom Wheelchair Lift:
   1. Base: LIFT-U Div. of Hogan Manufacturing, Inc. Escalon, CA.
   2. Optional: Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PERFORMANCE LIFTS

A. Specified: "Accessor I (VMW) Courtroom Lift".

B. Comply with the following:
   1. ASME A18.1 standard for lifts in public institutions.
   2. ADA requirements for wheelchair lifts.

C. Platform Guarding:
   a. Stationary runway sidewalls and landing entrance gate(s) as indicated on the drawings provided by the Owner's Representative.
      1) Minimum Height: As indicated on the drawings, but not less than 36 inches (900 mm).

D. Platform Size: Platform size shall not exceed 25 sq. ft.

E. Vertical Platform Speed: 10 feet (3.05 m) per minute nominal.

F. Maximum Travel: 24 inches (610 mm).

G. Enclose mechanical and electrical mechanisms and protect them from the weather.

H. Lift Mechanism: Electric, no hydraulics permitted. Carry lifting forces on 4 steel screw columns connected to platform for maximum stability.

I. Power Requirements: Install dedicated breaker protected service 115 VAC, 3-wire, 15 amp, single-phase service supplied from the building power source. Dedicated breaker protected service to be supplied.

J. Limit Switches: Equip lift with redundant upper and lower limit switches. Provide mechanical stops to limit travel in both directions.

K. Include:
   1. Powered landing Roll-up Barrier.
   2. Automatic Door Operator.

L. Fabrication: Construct lift of steel or aluminum structural frame with welded or bolted connections.

M. Operation: Low voltage (24 VDC) operated and constant pressure control switched, designed to be easily operated by a person with limited dexterity according to ADA requirements.

N. Controls: Equip lift with controls at the top, bottom landing and platform. Provide a security key switch to control unauthorized use.

O. Emergency Stop Button: Provide an illuminated emergency stop button on platform control panel.

P. Emergency Alarm System: Audible alarm that is automatically activated when the emergency stop button is depressed.

Q. Limit Switches: Equip lift with redundant upper and lower limit switches.

R. Battery: Provide backup battery.

S. Manual Lowering Device: Provide device to manually raise or lower the platform.

T. Finishes: Apply metal surfaces with a corrosion resistant powder coating. Coordinate installation of floor and wall finishes applied to the lift and specified in other sections. Refer to Finish Schedule for list of finishes.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Do not begin installation until substrates have been properly prepared.

B. Prepare report documenting unacceptable conditions.

C. Submit report to Contractor.

D. Do not proceed with work until corrective measures have been completed.

3.2 PREPARATION

A. Clean surfaces thoroughly prior to installation.

B. Prepare surfaces using methods recommended by manufacturer for achieving the best result for the project conditions.

3.3 INSTALLATION

A. Install in accordance with the following:
   1. Manufacturer's instructions.
   2. Approved Shop Drawings.
   3. Applicable regulations and codes.

3.4 FIELD TESTING

A. Upon completion of installation and as a condition of acceptance, provide necessary equipment and personnel to perform tests required.

3.5 CLOSEOUT ACTIVITIES

A. Secure required approvals from authorities having jurisdiction.

B. Provide training of Owner's personnel on proper use and operation of Wheelchair Lift.

3.6 PROTECTION

A. Protect installed products until completion of the project.

B. Touch-up, repair or replace damaged products before Substantial Completion.

3.7 MAINTENANCE

A. Perform maintenance in accordance with manufacturer's recommended procedures.

B. Perform maintenance as needed to assure proper and safe operation and as needed to avoid damage.

C. Perform the maintenance according to the following schedule:
   1. Cycle Testing for Special Access Lifts: Weekly (by designated Owner's representative).
   2. Routine maintenance: Every six (6) months or as required by authority having jurisdiction, whichever is more frequent. (by Owner's Maintenance Service Provider or Licensed Service Provider).
   3. Periodic Maintenance: Every five (5) years or as required by authority having jurisdiction, whichever is more frequent. . (by Owner's Maintenance Service Provider or Licensed Service Provider).
      Submit maintenance logs to Owner immediately upon completion of each inspection and service call. . (by Owner's Maintenance Service Provider or Licensed Service Provider).

END OF SECTION

DIVISION 20

MECHANICAL GENERAL REQUIREMENTS

SECTION 20 05 00
SPECIAL MECHANICAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Special Mechanical Requirements, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

C. Systems Included:
   1. Products:
      a. Access doors, panels, and frames.
      b. Covers for exposed vertical piping.
      c. Equipment guards.
      d. Motors and controls.
      e. Rain hoods and counter flashings.
      f. Penetrations.

D. Drawings Use and Interpretation:
   1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except when specifically dimensioned or detailed.
   2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
   3. Field measurements take precedence over dimensioned drawings.
   4. Piping and ductwork plans are intended to indicate size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
   5. Field verify locations and arrangement of existing systems and equipment.

E. Installation of Systems and Equipment:
   1. Installation is subject to clarification as indicated in reviewed Shop Drawings and Field Coordination Drawings.
      a. Generally, lay out piping requiring gravity drainage first; then lay out large pipe mains, ductwork and electrical conduit.
      b. This procedure is intended to promote orderly installation, but not to establish trade precedence.
      c. Dimensions indicated are limiting dimensions.
      d. Do not use equipment exceeding dimensions indicated on detail drawings or arrangements that reduce required clearances or exceed specified maximum dimensions.
      e. In mechanical equipment room aisles, maintain clear head room between floor and underside of ducts, pipes, and equipment to allow for future replacing of equipment and major components (e.g., coils, fans, heat exchangers, pumps).

F. Description of Systems:
   1. Provide materials resulting, upon completion, in functioning systems in compliance with performance requirements specified, and modifications resulting from reviewed Shop and Field Coordination Drawings.

G. High Altitude Operation:
   1. Capacity of equipment is indicated at actual operating conditions, unless otherwise noted.
   2. Size equipment to perform at 1200 FT above sea level.

1.2 QUALITY ASSURANCE

A. Perform work in accordance with following codes:
   1. State and local building, plumbing and mechanical codes.
   2. American Gas Association.
   3. National Electrical Code.
   4. National Fire Protection Association.
   5. Authorities Having Jurisdiction (AHJ).

B. Use only prime quality, new materials, apparatus and equipment.

1.3 PROTECTION

A. Provide covering and shielding for equipment provided to protect from damage.

B. Repair, restore and replace damaged items.

C. Protect nameplates on motors, pumps and similar equipment.

D. Protect plumbing fixtures and brass or chromium plated trim, valves and piping from damage.

E. Keep dirt and debris out of pipes and ducts by capping or plugging open ends.
   1. Keep plug or cap in place until final connections are made.

1.4 JOB CONDITIONS

A. Avoid interference and interruption of existing utilities and services.
   1. Schedule work which will cause interference or interruption in advance with Owner, Construction Manager, Architect, authorities having jurisdiction, and affected contractors.

B. Keep roads clear of materials and debris.

C. Examine Contract Documents to determine how other work will affect execution of mechanical work.

D. Examine site and become familiar with existing local conditions affecting work.

E. Determine and verify locations of existing utilities on or near site.

F. Make arrangements for and pay for necessary permits, licenses, and inspections.

G. Air Quality Permits: Contractor shall be responsible for obtaining EPA air quality permits. Coordinate permitting process with Owner.

H. Record drawings:
   1. Keep a complete set of mechanical drawings in job site office for indicating actual installation of mechanical systems and equipment.
   2. Use this set of drawings for no other purpose.
   3. Where material, equipment, or system components are installed differently from that indicated, indicate such differences clearly and neatly.
   4. At project completion, submit record set of drawings in accordance with Division 01.

I. Operation and Maintenance Data:
   1. See Division 01.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Motors:
   1. Base:
      a. Reliance Electric.
   2. Optional:

a. Baldor.
b. Century Electronics; E-Plus.
c. General Electric; Energy Saver.
d. Westinghouse Motor.

B. Shaft grounding ring for motors:
1. Base:
a. Aegis.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 ACCESS DOORS, PANELS, AND FRAMES

A. Access Doors, Panels and Frames:
1. See Section 08 31 16.
2. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings permit access to equipment, devices and piping requiring service, adjustment, or inspection. Provide security type access doors in security ceilings to permit access to equipment, devices and piping requiring service, adjustment, or inspection.
3. Size:
a. As required to allow access, inspection, service, and removal of items served.
b. Minimum 24 x 24 IN.

2.3 COVERS FOR EXPOSED VERTICAL PIPING

A. Covers for Exposed Vertical Piping:
1. 18 GA stainless steel (type 302) with No.4 finish.
2. Extend from 2 IN above ceiling to equipment or island partition.
3. Size covers to contain number of pipes served.
4. Minimize number of covers by enclosing maximum number of pipes in each drop.
5. Anchor to equipment or partition.
6. Fasten seams and joints with stainless steel pop rivets.

2.4 EQUIPMENT GUARDS

A. Equipment guards:
1. Use suitable structural frames with minimum 12 GA, 3/4 IN galvanized mesh, or expanded metal mesh.
2. Attach to equipment by removable clips and bolts with wing nuts, or other approved connectors.
3. At belts, provide opening for measuring RPMs.
4. Provide at belts, couplings, moving machinery and equipment in accordance with OSHA.
5. Design for easy access to belts and other items requiring replacement.

2.5 MOTORS AND CONTROLS

A. Motors:
1. Provide motors indicated in Mechanical Specification Divisions.
2. Ball or roller bearing type, premium efficiency type.
3. Starting and running characteristics consistent with torque and speed requirements of driven machine.
4. Motor efficiency:
a. NEMA Standard MG-1, part 31.
b. Indicate full load efficiency on each nameplate.
5. Rated in accordance with NEMA performance standards to carry full nameplate load continuously at maximum temperature rise of 40 degC above ambient with service factor of 1.15.
6. Motor powers as scheduled.

7. Do not allow power requirements of driven machine to exceed nominal nameplate rating of motor furnished.
8. Do not include service factor when selecting motor power.
9. Motors 1/2 HP and over: 208/3/60.
10. Motors less than 1/2 HP: 115/1/60.
11. Provide for items which require electric drive.

B. Motors for use with variable frequency drives (VFDs):
1. Provide with following to prevent bearing current damage:
a. Shaft grounding ring:
1) Discharges shaft currents to ground through use of frictionless conductive microfibers surrounding motor shaft.
2) Maintenance required: none.
3) Design to last for service life of motor.
4) RPM limitation: none.
5) Manufacturer: Aegis SGR.

C. Motor controls and wiring for controls:
1. Provide complete installation of controls and wiring for controls for Mechanical Specification Divisions packaged/pre-wired equipment.
a. Include line voltage controls, low voltage controls, control switches, starters, disconnects, conduit, and wiring.
b. Locate disconnects on outside of equipment enclosures or guards.
2. Starters, disconnects, conduit, and wiring furnished under Mechanical Specification Divisions shall comply with applicable Electrical Specification Divisions.
3. Where equipment is specified with packaged/pre-wired controls, but is furnished instead with loosely shipped components that require field wiring, coordinate complete installation and assume costs.

2.6 PENETRATIONS

A. Maintain fire and smoke ratings where mechanical items penetrate fire and fire/smoke rated building elements.

PART 3 - EXECUTION

3.1 GENERAL

A. When changes in location of work are required, obtain approval of Architect before making change.
1. Make changes at no extra cost.

B. Provide necessary offsets and crossovers in piping and ductwork, whether indicated or not.

C. Install piping and ductwork parallel to walls and vertically plumb.

D. Do not change indicated sizes without approval of Architect.

E. Electrical equipment:
1. Maintain space above electrical equipment rooms and closets clear of ductwork and piping.
2. Maintain space above panelboards, switchboards, motor control centers, or motor control panels clear of ductwork and piping.

F. Roof penetrations:
1. Make penetrations through roofs prior to installation of roofing.
2. For penetrations required after installation of roofing:
a. In built up roofing (BUR), provide curbs, cants and counter flashings.
b. In elastic sheet roofing (ESR), arrange and pay for flashing work by authorized roofer; provide counter flashings.

3. Repair and replace roof construction which is damaged by this work in manner which will not nullify roof warranty.

3.2 LOCATING SERVICEABLE DEVICES

A. Install devices, that may require adjustment or service maintenance, in accessible locations or provide flush-mounted access doors.
   1. Such devices include but are not limited to equipment, valves, filters, motors, drives, compressors, unions, traps, strainers, thermometers, gauges, switches, measurement devices, coils, detectors, dampers, sensors, monitors, backflow prevention devices, drains, floor sinks, cleanouts, test stations, signal devices, sprinkler heads, air vents, expansion joints, and system drains.
   2. Arrange piping, conduit, ducts, and related work to facilitate maintenance.
   3. Relocate items which interfere with access.

3.3 CUTTING AND PATCHING

A. Requesting openings in advance.
   1. Coordinate locations with work of other sections.

B. Avoid cutting, where possible, by setting sleeves or frames.

C. Before cutting of structural elements, obtain written approval of Structural Engineer.
   1. Use only approved methods.
   2. Neatly cut holes as approved by structural engineer to admit work.
   3. Do not weaken walls or floors; locate holes in concrete to avoid structural members.

D. Perform cutting, fitting, repairing, patching and finishing of work to permit installation of mechanical work.

E. Locate openings and sleeves to permit neat installation of piping, ductwork and equipment.

F. Do not remove or damage fireproofing materials.
   1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
   2. Repair or replace fireproofing removed or damaged.

G. Remove and replace existing ceilings for mechanical work in existing areas.

H. See Section 01 73 29.

3.4 INSTALLATION OF EQUIPMENT

A. Install equipment in accordance with manufacturer's recommendations and as specified.

B. Provide necessary anchoring devices and supports.
   1. Use structural supports suitable for equipment, or as indicated.
   2. Check loadings and dimensions of equipment with shop drawings.
   3. Do not cut building structural members.
   4. Provide equipment supports even though not detailed on architectural and structural drawings.

C. Coordinate fit of equipment support with layouts indicated.
   1. Where substitute equipment is used, revise indicated supports to fit.

D. Arrange for necessary openings to allow entry of equipment.
   1. Where equipment cannot be installed as structure is being erected, provide and arrange for building in of boxes, sleeves or other devices to allow later installation.

E. Provide concrete foundations (isolation pads) or housekeeping pads for mechanical equipment as follows unless indicated otherwise:
   1. Install 4 IN high concrete housekeeping pads. Outside dimension of pad shall be at least 4 IN larger in all directions than base of equipment or 9 IN from center of anchor, which ever is greater.

2. Use 3,000 PSI concrete.
3. Reinforce with No.4 bars, 12 IN OC each way, with short No.4 dowels into floor at 24 IN OC each way .
4. Chamfer top edges 3/4 IN.
5. Make faces smooth.
6. Set anchor bolts for equipment.

3.5 INSTALLATION OF EQUIPMENT FURNISHED BY OWNER OR OTHER DIVISIONS

A. Receive, uncrate and set in place mechanical equipment furnished by Owner or other Divisions.

B. Remove, relocate and reinstall existing mechanical equipment to be reused.

C. Provide rough-in and final connections to equipment requiring mechanical services.
1. See schedules.
2. Obtain rough-in data from inspection of same for existing equipment.
3. Obtain rough-in data from final shop drawings for equipment furnished by Owner or other divisions.

D. Install loosely shipped fittings, valves, and other items furnished as integral part of equipment.

3.6 PAINTING

A. See Section 09 91 23.

3.7 WORK IN EXISTING BUILDING

A. Where relocation of existing equipment and piping systems is necessary in areas providing uninterruptible services, schedule work for minimal down time during slack periods.

B. Assign an adequate crew to accomplish job in shortest time.

C. Fabricate and install interconnecting portions of these systems prior to shut down for final connections including valve assemblies in piping systems and dampers in ductwork.

D. Locate existing piping and make connections as required.
1. Do not cut into existing services without first verifying with Owner that service has been correctly identified.
2. Perform work interrupting service at time to cause least interference to normal operation of building.
3. Inform building engineering staff in advance of interruptions and provide estimate of duration.
4. Begin work only after engineering staff is fully informed and has agreed to schedule of service interruptions.

E. Maintain existing services and equipment unless indicated to be removed.

F. Salvage items in accordance with Section 02 41 00.

3.8 FIELD QUALITY CONTROL

A. Perform indicated tests to demonstrate workmanship, operation, and performance.
1. Conduct tests in presence of Architect and, if required, inspectors of agencies having jurisdiction.
2. Arrange date of tests in advance with Architect, manufacturer and installer.
3. Give inspectors minimum of 24 hours notice.
4. Furnish or arrange for use of electrical energy, steam, water or gas required for tests.
5. Furnish materials required for test.

B. Repair or replace equipment and systems found inoperative or defective and retest.
1. If equipment or system fails retest, replace it with products conforming to Contract Documents.
2. Continue remedial measures and retests until satisfactory results are obtained.

C. Test equipment and systems for each item, unless otherwise recommended by manufacturer.
   1. Tests specified in Section 20 08 00, Testing and Balancing need not be duplicated under other sections.

3.9 ADJUST AND CLEAN

A. Inspect equipment and put in satisfactory working order.

B. Clean exposed and concealed items: See Cleaning (Section 01 74 23).
   1. Clean air surfaces of coils, fans (including fan wheels and motors), air handler plenums and air filter frames.
   2. Clean floor drains, cleanouts, and plumbing fixtures.
   3. Clean specialties such as traps and strainers and equipment surfaces such as pumps, motors, boilers, chillers, etc.
   4. Clean finned elements of fin tube radiation with compressed air.
   5. Clean piping of tags, debris and other construction materials before insulating or painting.
   6. Clean debris including dirt and sand out of ductwork.

3.10 PUTTING SYSTEMS IN OPERATION - START UP

A. Prior to substantial completion and building occupancy, at time agreed to by Owner and Architect, put systems into satisfactory operation.
   1. At first heating or cooling season following substantial completion, put systems not yet operated under their seasonal loads into satisfactory operation.

B. Operate systems in satisfactory working order for period of 10 working days.
   1. After the 10 days, clean debris including dirt and sand out of ductwork.

END OF SECTION

SECTION 20 05 19
PIPING SPECIALTIES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Piping Specialties, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Pressure gauges.
   2. System drains.
   3. Thermometer wells and test gauge connections.
   4. Thermometers.
   5. Wye strainers for steam and hydronic systems.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Comply with applicable UL, ANSI and ASTM Standards.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Layout of piping showing expansion joints and manufacturer recommended locations for pipe anchor and guide locations.
   2. Include axial, lateral, and vertical stresses at anchors as calculated by expansion joint manufacturer. Stresses shall be compliant with ASME B31.1 requirements.

B. Product Data:
   1. Pressure gauges.
   2. Thermometers.
   3. Wye strainers.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pressure gauges:
   1. Base:
      a. Weiss Instruments.
   2. Optional:
      a. Trerice, HO.
      b. Marsh Instrument.
      c. US Gauge.
      d. Weiss Instruments.
      e. Weksler Instruments.
      f. Weston and Ernst.
      g. Winters.

B. Thermometers and Pressure Gauges:
   1. Base:
      a. Weiss Instruments.
   2. Optional:
      a. Marsh Instrument.
      b. Marshalltown Instrument.
      c. Palmer Instruments.
      d. Taylor Environmental Instruments.
      e. Trerice, HO.
      f. Weiss Instruments.
      g. Weksler Instruments.
      h. Weston and Ernst.
      i. Ashcroft.
      j. Winters.

C. Wye strainers:
   1. Base:
      a. Armstrong International
   2. Optional:
      a. Armstrong International.
      b. Spirax Sarco.
      c. Keckley, OC.
      d. Metraflex.
      e. Mueller Steam Specialty.
      f. Spence Engineering.
      g. Victaulic of America.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 EXPANSION JOINTS

2.3 PRESSURE GAUGES

A. Pressure gauges:
   1. Steam systems and water systems operating above 150 degF :
      a. Case and twist ring: 4-1/2 IN diameter, anodized aluminum.
      b. Socket: brass.
      c. Bourdon tube: Phosphor bronze.
      d. Movement: Bushed Brass Rotary.
      e. Dial: White aluminum, black markings.
      f. Pointer: Black or red anodized aluminum, slotted adjustable.
      g. Window: Glass.
      a. Siphon and gauge cock (low pressure steam): brass.
      b. Siphon and needle valve (medium and high pressure steam): brass..
      c. Accuracy: 1.0% full scale, ASME B40.1 Grade 1A.
      d. Range: Operating pressure to occur in middle half (25 % to 75%) of the full scale range of the fluid being measured.
      e. Connections: 1/4 IN or 1/2 IN NPT.
   2. Compressed air systems and water systems operating below 150 degF
      a. Case and Ring: 4 IN diameter, liquid filled, type 304 stainless steel case with polished stainless steel bayonet ring.
      b. Fill liquid: Glycerin.
      c. Socket: Brass with push-in restrictor.
      d. Bourdon tube: Phosphor Bronze.
      e. Movement: Brass rotary type with bushings.
      f. Dial: White aluminum with black markings.
      g. Pointer: Black or red anodized aluminum, adjustable.

h. Window: Clear acrylic.
i. Snubber and gauge cock: Chrome plated brass.
j. Accuracy: 1.0% full scale, ASME B40.1 Grade 1A.
k. Range:
1) Refer to pressure range schedule except as follows:
a) Pump suction gauges for open piping systems where elevation difference between pump center line and liquid level of open system is less than 50 feet: Compound type, indicating at least 30 IN Hg to 30 PSIG.
b) Fuel oil pump suction: Compound type, indicating to 210kPa 30 IN Hg to 30 PSIG.
l. Connections: 1/4 IN or 1/2 IN NPT.

3. Differential Pressure Gauges:
a. Dial:
1) Diameter: 4-1/2 IN.
2) Face: White with black numerals and pointers.
3) Body: Chrome plated brass.
4) Seals: Teflon.
5) Glass: Shatterproof.
b. Piston Sensor.
c. Accuracy: 2-1/2% over entire range.
d. Range selection: Approximately 50% of full range.
e. Accessories:
1) Pulsation damper.
2) Lever handle gauge cock.

4. Pressure gauge range schedule:

	Range PSIG	Fig. Interval PSIG	Inter. Gradu-ations PSIG	Bldg. Height Stories
Chilled/condenser water	0-60	5	1	to 4
Chilled/condenser water	0-100	10	1	over 4
Heating hot water	0-100	10	1	to 4
Heating hot water	0-160	20	2	over 4
Fire	0-400	50	5	
Cond. pump discharge	0-100	10	1	
LP Steam	0-60	5	1	
MP Steam	0-100	5	1	
HP Steam	0-300	25	5	
Domestic hot water	0-200	20	2	
Domestic cold water	0-200	20	2	

2.4 SYSTEM DRAINS

A. Valved drains (nonpotable water):
1. Piping 2 IN and smaller:
a. 1/2 IN V-13, or V-14 with male hose-thread outlet and brass cap.
2. Piping 2-1/2 IN and larger:
a. 1-1/2 IN V-13 or V-14 ball valve with 1-1/2 IN fire hose adapter and cap.

B. Valved drains (potable water):
a. 1/2 IN V-13 with plugged outlet.

C. On nonpotable systems, label system drains as nonpotable.

D. Valve standards: See section 20 05 23.

2.5 THERMOMETER WELLS (SOCKETS) AND TEST GAUGE CONNECTIONS

A. Temperature sensing wells (sockets) and test gauge connections:
   1. Brass or stainless steel.
   2. Provide extension necks for insulated piping.

2.6 THERMOMETERS

A. Liquid filled thermometers:
   1. Case: Industrial type molded polyester or die cast aluminum.
   2. Window: Shatterproof glass or acrylic.
   3. Liquid: Blue reading, non-mercury.
   4. Scale: 9 IN scale minimum, black lines and numbers.
   5. Accuracy: 1% of scale range.
   6. Angle adjustment: variable with angle adjusting screw.

B. Thermometers range schedule:

	Range degF	Division degF
Domestic hot water	32-180	2
Domestic cold water	32-100	1
Heating hot water	50-300	2
Condensate pump disc	50-300	2
LP steam	50-300	2
Chilled water at coils	32-130	1

2.7 WYE STRAINERS FOR STEAM AND HYDRONIC SYSTEMS

A. Wye strainers.
   1. Screwed or flanged.
   2. Body:
      a. 2 IN and smaller:
         1) Cast bronze, ASTM B62, screwed ends.
      b. 2-1/2 IN and larger:
         1) Cast iron, flanged ends.
         2) Coating: Rust inhibiting.
   3. Working pressure, non shock: 150 PSIG.
   4. Screens:
      a. Water: Bronze, monel or stainless steel.
         1) 2 IN and less: 3/64 IN perforations.
         2) 2-1/2 IN and larger: 1/8 IN perforations.
      b. Steam: Stainless steel or brass.
         1) 3/64 IN perforations.

PART 3 - EXECUTION

3.1 GENERAL

A. Install piping specialties according to manufacturer instructions and as specified.

3.2 PRESSURE GAUGES

A. Install filter type pressure snubbers at pumps and chillers.

B. Install siphons on steam gauges.

C. Install brass tee handle cock and 1/4 IN hard tempered tubing from gauge to pipe connection.

D. Install additional brass tee handle cock at gauge for panel mounted gauge.

E. Calibrate and zero gauges at job site.

3.3 SYSTEM DRAINS

A. At low points of piping systems, provide valved drains to allow complete drainage of each system.

B. Neither terminate nor run drains over electrical equipment.

3.4 THERMOMETER WELLS AND TEST GAUGE CONNECTIONS

A. Provide test thermometer well adjacent to each point where a temperature sensing device is required by control specifications and where piping schematics indicate thermometers.

B. Placement and sizing:
   1. For 4 IN piping and larger, place tee in piping to create perpendicular flow-to-stem measurement.
      a. Size stem length based on pipe size as indicated below:
         1) 4 and 5 IN pipe: 3-1/2 IN stem.
         2) 6 and 8 IN pipe: 6 IN stem.
         3) 10 and 12 IN pipe: 9 IN stem.
         4) 14 IN pipe and larger: 12 IN stem.
   2. For piping smaller than 4 IN , place oversize piping well and tee in 90-degree piping turn to create parallel flow-to-stem measurement.
      a. Stem length: 12 IN.
      b. Piping well length: 14 IN.
      c. Size piping well and tee based on pipe size as indicated below:
         1) 1/2 and 3/4 IN pipe: 1-1/4 IN well and tee.
         2) 1 IN pipe: 1-1/2 IN well and tee.
         3) 1-1/4 and 1-1/2 IN pipe: 2 IN well and tee.
         4) 2 IN pipe: 2-1/2 IN well and tee.
         5) 2-1/2 and 3 IN pipe: 4 IN well and tee.

3.5 THERMOMETERS

A. Where temperature control requires a temperature transmitter, a thermometer is not required in same location unless specifically required in equipment specifications.

B. Where 2 or more pumps are headered, provide one thermometer in suction header and one in discharge header.

3.6 WYE STRAINERS

A. Provide wye strainers as indicated in piping-system sections.

B. Connections to suit piping system.

C. Provide blow-down valves:
   1. Strainers 6 IN and larger: 1-1/2 IN blow-down valve.
      a. Pipe blow down to drain.
   2. Strainers 2 to 5 IN: 1 IN blow-down valve with 3/4 IN hose end connection and brass cap.
   3. Strainers 1-1/2 IN and smaller: 1/2 IN blow-down valve with 3/4 IN hose end connection and brass cap.

END OF SECTION

SECTION 20 05 23
MANUAL VALVES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Manual Valves, as indicated, in accordance with provisions of Contract Documents.

B. Definitions:
   1. Class: ANSI Class.
   2. SWP: Steam Working Pressure.
   3. WOG: Water/Oil/Gas non-shock working pressure.
   4. WWP: Cold water non-shock working pressure.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. This specification lists a variety of valves that may be applicable to the project. Not all valves listed are applicable to the project, refer to appropriate specs sections for project applicability.

B. Boiler system valves: ASME Boiler Code Specifications.

C. Fire protection valves: UL listed, NFPA and FM approved.

D. Valves for Potable Water: Shall comply with provisions called for by the Safe Drinking Water Act as amended by S3874 (the “Lead Free Law) or any subsequent amendments or addendums thereto.

E. Valve bodies, shells and seats: Designed, manufactured, and tested in accordance with the following:
   1. Pressure testing of steel valves: MSS SP-61.
   2. Butterfly valves: MSS SP-67.
   3. Cast iron gate valves, flanged and threaded ends: MSS SP-70.
   4. Cast iron swing check valves, flanged and threaded ends: MSS SP-71.
   5. Cast iron plug valves, flanged and threaded ends: MSS SP-78.
   6. Bronze gate, globe, angle and check valves: MSS SP-80.
   7. Valve pressure testing methods: MSS SP-82.
   8. Cast iron globe and angle valves, flanged and threaded ends: MSS SP-85.
   9. Diaphragm type valves: MSS SP-88.
   10. Resilient seated eccentric cast iron plug valves: MSS SP-108.
   11. Ball valves--threaded, socket-welding, solder joint, grooved, and flared ends: MSS SP-110.

F. Standard Specification for Composition of Bronze or Ounce Metal Castings: ASTM-B62.

G. Standard Specification for Steam or Valve Bronze Castings: ASTM-B61.

H. Iron body valves:
   1. Pressure containing parts: ASTM-A126, Grade-B.
      a. Standard Specification for Gray Iron Castings for valves, flanges and pipe fittings: ASTM-A126, Grade B.
   2. Face to face and end to end dimensions: ANSI/ASME-B16.10.
   3. Use domestic manufactured valves as defined by Buy American Act.

I. Valve stems: ASTM-B371, Alloy C69400; ASTM-B371, Alloy C65100H04 (rolled silicon brass); or other material equally resistant to dezincification.

J. Indicate following information on valves:
   1. Stamped or cast into body:
      a. Manufacturer's name or trademark.
      b. Pressure rating as Class, SWP, WOG, or WWP.
      c. "UL-FM" for UL-FM valves.
   2. Permanently attached to body:
      a. Valve's country of origin.

1.3 SUBMITTALS

A. Product Data:
   1. Valves.
      a. In addition to submittal requirements of Section 01 33 00, submittal shall include the following:
         1) For submittals with model numbers not listed in this section, include published cross reference sheet. Indicate association between submitted model number and the listed model number on the cross reference sheet.
         2) For each valve submitted indicate in which specification section(s) and in which system(s) the valve will be used.
      b. When valve assembly includes components other than the base valve body and handle (e.g., operator, valve box), include data on entire valve assembly.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Angle valves:
   1. Base:
      a. Nibco.
      b. Stockham .
   2. Optional:
      a. Crane Valves.
      b. Hammond Valve.
      c. Jenkins Valves.
      d. Lunken.
      e. Milwaukee Valve.
      f. Powell.
      g. Walworth.

B. Ball valves:
   1. Base:
      a. Milwaukee Valve.
      b. Nibco.
   2. Optional:
      a. Apollo.
      b. Crane Valves.
      c. Hammond Valve.
      d. Jamesbury.
      e. Jenkins Valves.
      f. Stockham.

C. Butterfly valves:
   1. Base:
      a. DeZurik.
      b. Milwaukee Valve.
      c. Stockham.
      d. Victaulic of America.

2. Optional:
    a. CenterLine Inds.
    b. Crane Valves.
    c. Jamesbury.
    d. Hammond Valve.
    e. Keystone Valve.
    f. Lunken.
    g. Mueller Steam Specialty.
    h. Nibco.
    i. Powell.
    j. Walworth.

D. High Performance Butterfly Valves:
1. Base:
    a. Dezurik.
2. Optioinal:
    a. Bray Controls.
    b. Neles (Jamesbury).

E. Check valves:
1. Base:
    a. Apco Valve & Primer.
    b. Nibco.
    c. Stockham Valves & Fittings.
2. Optional:
    a. Crane Valves.
    b. Hammond Valve.
    c. Kennedy Valve.
    d. Milwaukee Valve.
    e. Mueller Steam Specialty.
    f. Powell.
    g. Victaulic of America.
    h. Viking.
    i. Walworth.
    j. Waterous.

F. Globe valves:
1. Base:
    a. Stockham.
2. Optional:
    a. Crane Valves.
    b. Hammond Valve.
    c. Jenkins Valves.
    d. Lunken.
    e. Milwaukee Valve.
    f. Nibco.
    g. Powell.
    h. Walworth.

G. Plug valves:
1. Base:
    a. DeZurik.
    b. Resun Valves.
2. Optional:
    a. Milliken.
    b. Mueller Steam Specialty.
    c. Rockwell International.

d. Victaulic of America.

H. Valve boxes and stop boxes:
1. Base:
a. Tyler Pipe.
b. Western.
2. Optional:
a. Neenah Foundry.
b. Vulcan.
c. Local foundry.

I. Balancing valves (globe style):
1. Base:
a. Tour and Andersson.
2. Optional:
a. Armstrong.
b. Wheatley.
c. Mepco.

J. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Ball valves:
1. Port size: Standard.
2. Ball and stem material: 316 Stainless Steel unless noted otherwise in specific valve description.
3. Blow-out proof stems.
4. Reinforced Teflon (PTFE) (PTFE) seats.
5. Teflon (PTFE) (PTFE) seals.
6. Adjustable packing.
7. 3-piece valves:
a. May be standard port.
b. Repairable in line.

B. Butterfly valves:
1. Ninety degree operation.
2. Bubble-tight shut off, suitable for bi-directional dead-end service at rated pressure without use of downstream flange.
3. 2 IN extended neck.
4. Lugs, where specified, shall be drilled and tapped.
5. Operators:
a. 2-1/2 to 4 IN: Position lock handle.
b. 5 IN and larger: gear operator with 4-arm or wheel handle.
6. Bronze:
a. Viton seals.
b. Pressure rating: Refer to valve listings under Part 2.3.

C. High performance butterfly valves:
1. Ninety degree operation.
2. Bi-directional, drip-tight shut off at full pressure rating.
3. 2 IN extended neck.
4. Lugs shall be drilled and tapped.
5. Operator: gear type with 4-arm or wheel handle.
6. Body: carbon steel.
7. Disc: stainless steel.
8. Seat: RTFE.
9. Stem: stainless steel; blow-out proof.
10. Taper pins: compression type; stainless steel.

11. ANSI Class: 150.
12. Applicable fire test standard: API-607.

D. Chain operators:
1. Provide operators for valves located in mechanical spaces or in the mechanical piping chase adjacent to the service elevator housing the chilled water, heating hot water, and glycol heating hot water mains 8 FT or higher above floor.
2. Chain lever or chain sprocket operator with sufficient chain to reach within 5 FT of floor.
3. Remote operator accessories by same manufacturer as valve.
4. Do not provide for Fire Protection valves.

E. End styles, general:
1. Compatible with piping systems served.
2. Flanged valves:
a. Class 125 cast iron: Flat flanges.
b. Class 250 cast iron: Raised flanges.
c. Ductile iron: Raised flanges.
3. Valves with solder ends for use in brazed piping systems shall be constructed for brazing.

F. Extended necks and stems:
1. For valves specified with extended necks or stems, provide design that isolates moving valve parts from insulation.
2. For valves specified with extended necks or stems and memory stops, provide design that allows access to memory stop without disturbing insulation.

G. Packing shall not contain asbestos.

H. Plug valves:
1. Eccentric plugs:
a. Non-lubricated valves with resilient seats shall be suitable for 250 degF service.
b. Rubber seated eccentric plugs: Bolted stem seals shall permit replacement of packing without removing valve from line or removing parts other than operator.

2.3 VALVES

A. General:
1. Example model numbers may indicate a general series, or may be abbreviated. They may not reflect all features described. Provide valves with described features.
2. Specified requirements are minimums. Valves that meet or exceed specifications may be submitted.
3. Where valves are installed in piping systems using ring seal crimped pipe joining systems acceptable manufactures who manufacture valves designed for connection to ring seal crimped systems are acceptable. Refer to specification sections 22 10 16 Plumbing Piping and 23 21 13 Hydronic Piping Systems for acceptable applications of Ring Seal Crimped piping systems..

B. V-6: Globe valve, Class 150, bronze body, union bonnet, renewable Teflon (PTFE) disc, solder. Example: Stockham B-24T.

C. V-7: Globe valve, same as V-6 except threaded. Example: Stockham B-22T.

D. V-8: Globe valve, Class 125, cast iron body, bronze trim, bolted bonnet, OS&Y, renewable seat and bronze disc, flanged. Example: Stockham G-512.

E. V-9: Globe valve, Class 200, bronze body, union bonnet, renewable plug type seat and disc, threaded. Example: Stockham B-62.

F. V-10: Globe valve, same as V-8 except Class 250. Example: Stockham F-532.

G. V-11: Ball valve, 150 PSI SWP, 400 PSI WOG bronze body, adjustable memory stop, 3-piece construction, extended stem, solder. Example: Milwaukee UPBA-350S.

H. V-12: Ball valve, same as V-11 except threaded. Example: Milwaukee UPBA-300S.

I. V-13: Ball valve, 150 PSI SWP, 400 PSI WOG bronze body, 2-piece construction, extended stem, solder. Example: Milwaukee BA-450S.

J. V-14: Ball valve, same as V-13 except threaded. Example: Milwaukee BA-400S.

K. V-15: Ball valve, 150 PSI SWP, 600 PSI WOG, 29 IN Hg vacuum service, full port, bronze body, 3-piece construction, chrome plated brass ball, Teflon seats, cleaned and capped for oxygen service, lockable or non-lockable as specified, color coded handle to match gas service, braze. Example: Milwaukee BA-350.

L. V-16: Ball valve, 150 PSI SWP, 600 PSI WOG, 250 PSI UL listed for flammable liquids and LP gas, bronze body, 2-piece construction, full or standard port, bronze ball, non-lubricated, threaded. Example: Nibco T-580-70-UL & T-585-70-UL.

M. V-17: Angle valve, Class 125, bronze body, screwed bonnet, bronze disc, threaded. Example: Stockham B-216.

N. V-18: Angle valve, Class 125, cast iron body, bolted bonnet, bronze trim, renewable seat and disc, flanged. Example: Nibco F-818-B.

O. V-19: Angle valve, Class 200, bronze body, union bonnet, bronze disc, threaded. Example: Stockham B-237.

P. V-20: Angle valve, Class 250, cast iron body, bronze trim, flanged. Example: Stockham F-541.

Q. V-21: Angle valve, automatic stop-check, Class 250, cast iron body, bolted bonnet, renewable disc and seat, flanged. Example: Stockham F-541.

R. V-22: Check valve, in-line pattern, spring-operated double doors, Class 250, cast iron body, renewable bronze doors and Viton-A seal, Inconel springs, stainless steel trim, flat faced wafer. Example: Stockham WG-976.

S. V-23: Check valve, Y-pattern, horizontal swing, Class 150, bronze body, threaded cap, renewable Teflon (PTFE) disc and seat, threaded. Example: Nibco T-433-Y.

T. V-24: Check valve, Y-pattern, horizontal swing, Class 125, bronze body, threaded cap, renewable bronze disc and seat, solder. Example: Nibco S-413-Y-LF.

U. V-25: Check valve, same as V-23 except Class 125. Example: Nibco T-413-Y-LF.

V. V-26: Check valve, in-line pattern, spring-operated disc, Class 125, bronze body, renewable Teflon (PTFE) disc and seat, 316 stainless-steel spring, threaded. Example: Nibco T-480-Y.

W. V-27: Check valve, T-pattern, horizontal lift, Class 150, bronze body, union bonnet, renewable Teflon (PTFE) disc and seat, threaded. Example: Stockham B-322-T.

X. V-28: Check valve, T-pattern, horizontal swing, Class 125, cast iron body, bolted bonnet, bronze trim, renewable bronze or cast iron disc and seat, flanged. Example: Stockham G-931.

Y. V-29: Check valve, in-line pattern, spring-operated double doors, Class 125 (cast iron body) or Class 150 (steel body), Buna-N or EPDM seal, aluminum bronze or stainless steel doors, 316 stainless steel spring; grooved, threaded, flanged, wafer, or lugged at locations other than equipment; grooved, flanged or lugged if between equipment and its isolation valve. Example: APCO L9000.

Z. V-30: Check valve, silent, in-line pattern, spring-operated disc, Class 125, cast iron body, renewable bronze disc and seat, stainless steel spring, flat faced wafer. Example: Nibco W-910-B.

AA. V-31: Check valve, same as V-23 except Class 200. Example: Nibco T-473-Y.

BB. V-32: Check valve, same as V-28 except Class 250. Example: Stockham F-947.

CC. V-33: Butterfly valve, 200 PSI WWP; 27 IN Hg vacuum; cast or ductile iron body; EPT (EPDM) sleeve; stainless steel stem; aluminum-bronze or stainless steel disc; lugged. Example: Stockham L#-7#2.

DD. V-34: Butterfly valve, same as V-33 except wafer. Example: Stockham L#-5#2.

EE. V-35: Butterfly valve, 200 PSI WWP for 12 IN and smaller, 175 PSI WWP for 14 IN and larger; 27 IN Hg vacuum for all sizes; cast or ductile iron body; EPT (EPDM) seat; stainless steel stem; replaceable forged brass, aluminum-bronze, stainless steel, or EPDM coated ductile iron disc; grooved. Example: Victaulic 300/709.

FF. V-36: Eccentric plug valve, 175 PSI WOG, cast-iron body, bronze or nickel-plated cast-iron plug, Isobutene-Isoprene steam and plug seals, high-temperature plug face, capped drip tap on seat end of valve, memory stop, lever handle, threaded. Example: DeZurik 499S.

GG. V-37: Eccentric plug valve, 175 PSI WWP for 12 IN and smaller, 150 PSI WWP for 14 IN and larger, cast-iron body, Viton filled TFE U-ring seal, Isobutene-Isoprene plug face, memory stop; lever handle for sizes 2-1/2 to 4 IN; gear operator with handwheel actuator for sizes 6 IN and larger; flanged. Example: DeZurik 118F.

HH. V-38: Eccentric plug valve, same as V-36 except flanged, or grooved. Example: DeZurik 499.

II. V-39: Ball valve, same as V-13 and V-14 except include adjustable memory stop. Example: Milwaukee BA-100S and BA-150S.

JJ. V-40: Butterfly valve, 200 PSI WWP, bronze body, adjustable memory stop with visual disc position range of 90 degrees, stainless steel disc and stem, Viton seal, threaded. Example: Milwaukee BB2-100.

KK. V-41: Plug valve, lubricated, 200 PSI WOG, semi-steel, bottom or bolted-top entry, UL listed for application, lubricant compatible with application, short pattern flanged. Example: Resun R-1431.

LL. V-42: Not used.

MM. V-51: Butterfly valve, UL-FM, 250 PSI WWP, ductile iron body, O-Ring seals, aluminum-bronze or ductile-iron disc, stainless steel stem, Buna-N seal, manual geared operator with visual position indicator, lugged. Example: Nibco WD-3510/GD-4765.

NN. V-54: Check valve, in-line, spring-operated single or double door(s), UL-FM, 200 PSI WWP, cast iron body, renewable bronze door and rubber or EPDM seat, stainless steel spring, wafer or grooved. Example: Stockham WG-990.

OO. V-55: Butterfly valve, UL listed, 175 PSI WWP, bronze body, stainless steel stem and disc, Viton seal, threaded. Example: Milwaukee BB2-100.

PP. V-56: Butterfly valve, same as V-40 except include extended neck, solder. Example: Milwaukee BB2-350.

QQ. V-57: Butterfly valve, same as V-40 except include extended neck, threaded. Example: Milwaukee BB2-100.

RR. V-58: Not used.

SS. V-59: Butterfly valve, same as V-55 with tamper switch. Example: Milwaukee BB2-100.

TT. V-60: Plug valve, lubricated, 125 PSI WOG semi-steel, bottom or bolted-top entry, UL listed for application, lubricant compatible with application, threaded. Example: Resun R-1430.

UU. V-61: Butterfly valve, UL-FM, 175 PSI WWP, coated cast or ductile iron body, aluminum bronze or ductile iron disk with EPDM coating, manual geared operator with visual position indicator, grooved. Example: Victaulic 708.

VV. V-62: Butterfly valve, 300 PSI WOG, 27 IN vacuum, bronze body, ductile iron disk with EPDM coating, extended neck, grooved. Example: Victaulic 600.

WW. V-63: High performance butterfly valve, Class 150, carbon steel body, RTFE seat, stainless steel shaft, stainless steel disc, TFE packing, wafer. Base: Bray/McCannalok Series 41; Optional: Dezurik BHP or Flowseal Series HP.

XX. V-64: Globe-style balancing valve, Y-pattern design, rated for 300 PSI WWP and 250 degF, cast copper alloy construction, dual pressure/temperature read-out ports, calibrated handwheel with minimum (4) 360 degree adjustment turns and hidden tamper-proof memory stop, threaded or sweat connections and suitable for positive shut-off. Example: Tour and Andersson STAD/STAS.

YY. V-65: Globe style balancing valve, Y-pattern design, rated for 250 PSI WWP and 250 degF, cast iron body fitted with copper alloy components, dual pressure/temperature read-out ports, calibrated handwheel with minimum (5) 360 degree adjustment turns and hidden tamper-proof memory stop, Class 125 flanged or grooved connections, and suitable for positive shut-off. Example: Tour and Andersson STAF/STAG.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Refer to individual sections for specific valve installation requirements.

B. Keep valves clear of pull spaces.

C. Install valves in accessible locations for operation, removal, inspection, and repair of valves and equipment.

D. Install gate and globe valves with stem in vertical upright to horizontal position.

E. Install butterfly valves with stem in horizontal position.

F. Install diaphragm valves to be self draining.

G. Support valves individually to relieve pipe stress and allow equipment removal.

H. Follow manufacturer's recommendation for disassembly of valves for end joining method employed.

I. Provide globe valve in bypass around control valves. Coordinate with Controls Contractor.

J. Provide shut off valve on each side of control valve. Coordinate with Controls Contractor.

END OF SECTION

SECTION 20 05 29
PENETRATIONS AND SUPPORTS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Penetrations and Supports, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Penetrations.
   2. Pipe hangers and supports.
   3. Pipe and equipment anchors.

C. Definitions:
   1. UCSS: Universal Channel Strut System.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Pipe hanger standards:
   1. Manufacturers Standardization Society (MSS) SP-58, SP-89 and SP-69, as referenced.
   2. ASME/ANSI B31.1.

1.3 SUBMITTALS

A. Product Data:
   1. Pipe hangers:
      a. Identify each hanger according to systems, pipe sizes, and orientations on which it will be used.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe hangers:
   1. Base:
      a. PHD Manufacturing.
   2. Optional:
      a. Anvil International.
      b. Cooper B-Line.
      c. Tolco Inc.
      d. Erico International.

B. Concrete inserts, pre-pour:
   1. Base:
      a. Hilti.
   2. Optional:
      a. Simpson.
      b. Powers Rawl.
      c. Tolco.
      d. B-line.

C. Concrete inserts, post-pour:
   1. Base:
      a. Hilti.
   2. Optional:
      a. Simpson.
      b. Powers Rawl.

D. Factory-fabricated supports for insulated pipe:
   1. Base:
      a. Pipe Shields.
   2. Optional:
      a. B-Line Systems.
      b. Power Piping.

E. Pipe and equipment anchors:
   1. Base:
      a. Shop fabricated.
   2. Optional:
      a. Field fabricated.

F. Factory-fabricated pipe supports at plumbing fixtures:
   1. Base:
      a. Sioux Chief Manufacturing.
   2. Optional:
      a. B-Line Systems.
      b. Holdrite.
      c. Sumner.

G. Universal channel strut system:
   1. Base:
      a. Unistrut (Tyco Electrical and Metal Products).
   2. Optional:
      a. Erico International.
      b. Cooper B-Line.
      c. Tolco, Inc.

H. Insulation Saddles:
   1. Base:
      a. PHD Manufacturing.
   2. Optional:
      a. Buckaroos, Inc.

I. Elastomeric Pipe Insulation Saddles:
   1. Base:
      a. Armacell engineered foams.

J. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PENETRATIONS

A. Penetrations - general:
   1. For concrete walls, floors, roofs, foundations, footings and grade beams, provide openings sufficiently sized to allow free movement of piping with insulation continuous through sleeve.
   2. Coordinate penetrations required with existing structural conditions. Obtain approval prior to coring as to avoid adversely affecting structural integrity.
   3. Create openings by placing sleeves prior to pouring of concrete in accordance with requirements indicated on structural drawings.

4. Core drilling or cutting will not be permitted without prior written approval by structural engineer.
5. Opening diameters:
   a. Minimum 3 IN.
   b. Bare pipe: Minimum 1 IN larger than outside diameter of pipe.
   c. Insulated pipe: Minimum 1-1/2 IN larger than outside diameter of insulation.
   d. Diameter suitable for construction tolerances and to receive sealant.
6. Openings for future work: Same as this work.
7. Coordinate detailing of roof, foundation wall, and slab-on-grade penetrations with roofing, waterproofing, and vapor retarder installers. Protect continuity of roofing, waterproofing, and vapor retarder systems.

B. Pipe entrance wall sleeve and anchoring:
1. Provide steel, heavy wall welded or seamless pipe sleeve full circle continuously welded water stop plate.
2. Provide sleeve full length of wall thickness and protect with a primer coat.
3. Structurally secure pipe to withstand water hammer force.
   a. Extend exterior piping material into building a minimum of 12 IN.
   b. Provide a mechanical joint on interior end of pipe and mechanical tie in back to adjoining structural, exterior, wall.
4. Provide "Link-Seal" on pipe at exterior side of sleeve.

C. Water dams:
1. Construct water dams to meet either of the following criteria:
   a. Steel pipe with flange water dam:
      1) Construct water dam by welding together Schedule 40 steel pipe and steel flange to be water tight.
      2) Cut flange from flat steel of same thickness as pipe wall. Flange ring width shall be 1 IN minimum.
      3) Inside diameter of dam shall be approximately 1 IN larger than outside diameter of piping or its insulation, which ever is larger.
      4) Install top of water dam to be 4 IN above the finished floor.
      5) Permanently anchor dam flange to the floor, and seal the flange-to-floor joint water tight.

D. Sealants:
1. Seal annular space around piping.
2. Maintain fire and smoke ratings at pipe penetrations of fire and fire/smoke rated building elements.
3. For non-rated floors and walls see Section 07 92 16.
4. For exterior and foundation walls: Use synthetic rubber seals, "Link-Seal" water proof material or system.
   a. Optional sealing of pipe with oakum stop and caulk on exterior side is acceptable.
5. Seal water dams to floor in accordance with Section 07 92 13.

2.3 PIPE HANGERS

A. Pipe hangers - General:
1. Materials, design and manufacture: MSS SP-58.
2. Fabrication and installation: MSS SP-89.
3. Selection and application: MSS SP-69.
4. Hangers and channels, angles, and supporting steel: Galvanized unless indicated otherwise.
5. Pipes running parallel may be supported on trapezes.
6. Hanger rods of continuous thread type: Galvanize after threads are cut.
7. Galvanize structural steel, angles, rods, channels, and hardware located in boiler, mechanical, and fan rooms and on roofs.
8. Where grooved couplings are used, place hanger within 2 FT each side of fittings or refer to manufacturer's pipe support and anchorage guide.

9. Screw threads on hangers and fittings: Conform to Class 2A and 2B of ANSI/ASME-B1.1.

B. Structural considerations:
1. Steel or concrete roof/floor system including slabs or roof deck shall be in place and complete before installation of mechanical piping system.
2. Space hangers so maximum individual hanger load will not exceed values listed in paragraph "Pipe hanger loading".
3. Do not attach hangers to steel roof deck.
4. Do not attach hangers larger than 1/2 IN diameter to bottom of concrete filled floor or roof deck.
5. Individual hanger loads exceeding 1000 lbs attached to the same deck span shall not be spaced closer than 5 FT on center.
6. The sum of all hangers supported by a slab span in a 5 FT by 5 FT area shall not exceed 1000 lbs.
7. Attach hangers to beams whenever possible.

C. Pipe hanger spacing:
1. Locate hangers at each change of direction.
2. Space hangers at or within following maximum limits:

	Standard Steel		Copper	
Pipe Diameter	Fluid	Vapor	Fluid	Vapor
1/2 - 1 IN	7 FT	8 FT	5 FT	6 FT
1-1/4 - 2 IN	7 FT	9 FT	7 FT	9 FT
2-1/2 - 3 IN	11 FT	14 FT	9 FT	13 FT
3-1/2 - 4 IN	13 FT	16 FT	11 FT	15 FT
5 - 6 IN	16 FT	19 FT	13 FT	18 FT
8 - 14 IN	16 FT	24 FT	16 FT	23 FT
16 IN	12 FT	24 FT		

3. For pipe larger than 16 IN diameter, see mechanical drawing for location of hanger supports.
   a. If not shown on plans, provide shop drawings for approval showing location of hangers and method of support from structure.
4. Fire protection piping: See Section 21 10 00.
5. For cast iron pressure piping, space maximum 12 FT OC.
   a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
6. For cast iron soil piping, space maximum 10 FT OC.
   a. Provide minimum of one hanger per pipe section close to joint on barrel and at change of direction and branch connections.
7. For piping materials not covered in this spec, space hangers according to manufacturer's recommendations.

D. Pipe hanger rod loading:
1. Total hanger rod load (including piping, insulation, and fluid) not exceeding following limits:

Nominal Rod Diameter	Maximum Load
3/8 IN	560 LB
1/2 IN	890 LB
5/8 IN	1460 LB
3/4 IN	2030 LB

2. Do not exceed manufacturer's recommended maximum safe load if smaller than above.

E. Pipe hangers for uninsulated pipe:
1. Independent hangers: MSS SP-69 type 1, 3, 4, 5, 7, 9, 10, 11, 12, 24, 41, 43, 44, 45, or 46.
   a. Types 7 and 10: Not allowed on pipe sizes greater than 6 IN.

2. Hangers used with trapezes:
   a. MSS SP-69 type 24 or 26.
   b. Hanger designed as part of UCSS.
3. Hangers supporting bare copper pipe:
   a. Copper plated or electro-galvanized hangers. Provide factory-applied felt or plastic padding to eliminate contact between support and copper pipe.
4. Hangers supporting bare glass pipe:
   a. For horizontal piping, use electro-galvanized supports with factory-applied felt or plastic padding to eliminate contact between metal and glass.
   b. For vertical piping, use electro-galvanized supports with factory-applied 1/4 IN thick solid neoprene or Buna-N pads to eliminate contact between metal and glass.

F. Pipe hangers for insulated pipe:
1. Hangers shall support piping from outside diameter of insulation.
2. Independent hangers: MSS SP-69 type 1, 3, 7, 9, 10, 41, 43, 44, 45, or 46.
   a. Types 7 and 10: Not allowed on pipe sizes greater than 6 IN.
3. Hangers used with trapezes:
   a. Pipe sizes 2 IN and smaller: MSS SP-69 type 26.
   b. Pipe sizes 2-1/2 IN and larger:
      1) MSS SP-69 type 24 or 26.
      2) Hanger designed as part of UCSS.
4. Pipe sizes 2 IN and smaller: Use hanger with insulation protection shield: MSS SP-69 type 40.
5. Pipe sizes 2-1/2 IN and larger: Use hanger with factory-fabricated support:
   a. 100 PSI, waterproofed calcium silicate fully encased in sheet metal shield.
      1) Pipe supported on rod hangers: Pipe Shields Models A1000, A2000, A3000, A4000 and A9000.
      2) Pipe supported on flat surfaces: Pipe Shields Models A1000, A2000, A5000, A6000 and A7000.
      3) Pipe supported on pipe rolls: Pipe Shields Models A3000, A4000, A5000, A6000 and A8000.
   b. Extend insulation inserts 1 IN beyond shields on refrigerant and chilled water lines.
   c. For steam piping 8 IN and larger, provide supports with slide bases.
6. For piping systems insulated with Elastomeric pipe insulation, composite Elastomeric and high density insert may be used:
   a. Jacket: 30 mils stainless steel.
   b. Basis: Armacell Armafix NPH pipe hanger inserts.
   c. Coordinate with section 20 07 00 Pipe, Duct and Equipment Insulation for applicability.
7. Steam pipe sizes 8 IN and larger: Use MSS SP-69 hanger type 41, 43, 44, 45, or 46 with support indicated for pipe sizes 2-1/2 IN and larger.

G. Pipe hangers in other situations: See MSS-SP-69.

H. Trapezes:
1. Suspend trapezes from concrete inserts, approved structural clips or beam clamps.
2. Construct trapezes of galvanized angle iron, UCSS channels, or other structural shapes with flat surfaces for point of support.
3. See pipe hanger paragraphs for hanger types allowed with trapezes.

I. Vertical pipe supports and guides:
1. Support vertical pipe runs in pipe chases from the top and every other floor down.
2. Provide pipe guides for lateral movement on alternating floors of pipe supports.

J. Concrete inserts:
1. Pre-pour concrete inserts:
   a. Continuous-slot or individual concrete inserts for use with hangers for piping and equipment exposed in labs and classrooms, and as required.
   b. Provide inserts in time for installation in concrete.

c. Continuous-slot inserts:
   1) B-Line Figure B22I, B32I, B42I or B52I.
d. Individual inserts:
   1) Grinnell Figure 282, or 281.
   2) Do not exceed manufacturer's recommended load on insert.

2. Post-pour concrete inserts:
   a. Type: Drop-In wedging type tapped for threaded rods. At concrete slabs on steel deck, install anchor in top of deck flute.
   b. Minimum embedment depth and base material thickness per anchor size shall be according to the following schedule:

Anchor Size IN	Minimum Base Material Thickness IN	Minimum Embedment Depth IN
1/4	3	1
3/8	3-1/8	1-9/16
1/2	4	2
5/8	5-1/8	2-9/16
3/4	6-3/8	3-3/16

K. Beam clamps:
   1. Pipe size 3 IN and smaller:
      a. MSS SP-69 types 19 or 23.
   2. Pipe sizes larger than 3 IN but smaller than 8 IN:
      a. Malleable-iron beam clamp: MSS SP-69 type 30.
      b. Iron beam clamp: B-Line B3055 or equal.
   3. Pipe sizes 8 IN and larger:
      a. Forged steel beam clamps: MSS SP-69 type 28 or type 29.
      b. Steel Beam clamps: B-Line B3291 through B3298 or equal.

2.4 PIPE SUPPORTS AT PLUMBING FIXTURES

A. Pipe supports at plumbing fixtures:
   1. Fire-treated dimensional lumber.
   2. Factory-fabricated metal brackets.
      a. Plastic grommets/inserts factory fabricated for specific pipe diameters and materials.
   3. Factory-fabricated PVC pipe supports and pipe fasteners.
      a. Fastening method: Stainless-steel bands and screws.
      b. PVC: Fire retardant.

PART 3 - EXECUTION

3.1 GENERAL

A. Install components as indicated and in accordance with manufacturer's instructions and recommendations.

3.2 PENETRATIONS

A. Coordinate locations of openings in structural systems with Architect.

B. Maintain fire and smoke ratings at pipe penetrations of fire and fire/smoke rated building elements.

C. Set sleeves plumb or level, in proper position, tightly fitted into work.
   1. Remove sleeves before installing piping.

D. Provide water dams around pipes penetrating the floor in wet areas such as the following:

1. Mechanical room.

3.3 PIPE SUPPORTS AT PLUMBING FIXTURES

A. Pipe supports at plumbing fixtures:
   1. General: Fasten piping to supports within 8 IN of final fixture connection point (valve).
   2. Fire-treated wood:
      a. Fasten wood to studs with screws.
      b. Fasten piping to wood support:
         1) Pass piping through drilled holes no more than 1/8 IN larger than outside diameter of pipe.
         2) Or fasten with pipe straps: Use screws to fasten straps to wood.
   3. Factory-fabricated brackets:
      a. Fasten brackets to studs with screws.
      b. Galvanized brackets:
         1) Fasten piping to brackets with plastic grommets/inserts.
      c. Copper-clad brackets:
         1) Use only with copper piping.
         2) Isolate copper-clad brackets from metal studs with insulating tape, felt, or rubber pads.
         3) Fasten piping to brackets by soldering or by using plastic grommets/inserts.
   4. Factory-fabricated PVC supports:
      a. Fasten brackets to waste piping, fixture carriers, or studs.

END OF SECTION

SECTION 20 05 50
MECHANICAL SOUND AND VIBRATION CONTROL

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Mechanical Sound and Vibration Control, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Vibration isolators.
   2. Bases.
   3. Piping connections.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Comply with ASHRAE, ASTM and AASHO standards.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Submit drawings for each piece of isolated equipment.
   2. Include drawings of spring isolators with equipment submittal. Include the following information:
      a. Spring diameter.
      b. Deflection.
      c. Compressed spring height.
      d. Solid spring height.
      e. Point location of each isolator.
      f. Calculated load at each point.
      g. Field static deflection.
      h. Calculated horizontal loading and bolt requirements.
      i. Indicate base clearance of 1 IN.
      j. Installation instructions and drawings.

B. Product Data:
   1. Vibration isolators, bases, and piping connections for equipment: Include with equipment submittal.
   2. Vibration isolators, bases, and piping connections for applications other than equipment.
      a. Indicate specific applications with submittal.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Mechanical Sound and Vibration Control:
   1. Base:
      a. Mason Industries.
   2. Optional:
      a. Vibration Mountings and Controls.
      b. Vibration Eliminator.
      c. Korfund Dynamics.
      d. Amber/Booth.

e. California Dynamics.
f. Vibro-Acoustics.
g. Kinetics Noise Control.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Provide piping and equipment isolation systems as specified.

B. Select vibration isolators in accordance with weight distribution to produce reasonably uniform deflection.

C. Provide vibration isolation equipment including isolators, bases, and piping connections from a single manufacturer of vibration isolation equipment.

D. Coat vibration isolation systems exposed to moisture and an outdoor environment as follows:
1. Hot dip galvanize steel parts.
2. Coat springs with neoprene.
3. Cadmium plate hardware.

2.3 VIBRATION ISOLATORS

A. Neoprene Isolators:
1. Type 1 isolator:
a. Similar to ASHRAE Type 1 isolator.
b. Neoprene wafer pads.
c. Durometer or hardness shall suite application.
d. Square waffle pattern on 1/2 IN centers.
e. Waffle pad thickness: 3/4 IN.
f. Provide steel backing plate where recommended by manufacturer.
g. For non-bolted applications, provide adhesive on both sides of isolator.
2. Type 2 isolator:
a. Similar to ASHRAE Type 2 isolator.
b. Molded neoprene, double-deflection.
c. Provide color coded neoprene-stock elements for easy identification of rated load capacity.
d. Completely imbed steel top plate and base plate in neoprene elements.
e. Where neither isolator nor equipment manufacturer recommends bolting, provide friction pads both top and bottom.
f. Where either isolator or equipment manufacturer recommends bolting, provide bolt holes in base plate and tapped holes in top plate.
3. Type 2 isolator for suspended supports:
a. Molded neoprene, double-deflection.
b. Similar to ASHRAE Type 2 isolation hanger.
c. Provide color coded neoprene-stock elements for easy identification of rated load capacity.
1) Provide integral extension bushing on element where it contacts hanger frame to prevent metal to metal contact between frame and hanger rod.
d. Provide hanger for direct attachment to flat iron duct straps.

B. Spring Isolators:
1. Type 3 isolator:
a. Similar to ASHRAE Type 3 spring isolator.
b. Free standing and laterally stable without housings, snubbers or guides.
c. Provide 1/4 IN thick neoprene acoustical friction pads between baseplate and structure.
d. Provide leveling bolts for rigid attachment to equipment.
e. Spring diameter: Not less than 0.8 of compressed height of spring at rated load.

f. Spring shall have minimum additional travel to solid equal to 50 percent of rated deflection.

2. Type 3 isolator for suspended supports:
   a. Similar to ASHRAE Type 3 spring hanger.
   b. Provide Steel spring and neoprene cup element in series inside bottom of hanger frame.
      1) Provide steel washer in cup to properly distribute load on neoprene and prevent its extrusion.
   c. Provide integral extension bushing on neoprene element where it contacts hanger frame to prevent metal to metal contact between frame and hanger rod.
   d. Minimum additional spring travel to solid: 50 percent of rated deflection.
   e. Spring diameter and hanger frame's lower hole size shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting hole and short circuiting spring.
3. Type 3N isolator for suspended supports:
   a. Similar to ASHRAE Type 3 spring hanger.
   b. Provide Steel spring and molded neoprene element in series inside bottom of hanger frame.
      1) Provide steel washer in cup to properly distribute load on neoprene and prevent its extrusion.
   c. Provide color coded neoprene-stock elements for easy identification of rated load capacity inside top of hanger frame.
   d. Provide integral extension bushing on neoprene elements where they contact hanger frame to prevent metal to metal contact between frame and hanger rod.
   e. Minimum additional spring travel to solid: 50 percent of rated deflection.
   f. Spring diameter and hanger frame's lower hole size shall be large enough to permit hanger rod to swing through a 30 degree arc before contacting hole and short circuiting spring.
4. Type 3P isolator for suspended supports:
   a. Similar to ASHRAE Type 3 spring hanger.
   b. Same as Type 3N except spring is precompressed to rated deflection so piping/equipment is maintained at a fixed elevation during installation.
   c. Provide a release mechanism to free spring after installation is complete and hanger is subjected to its full load.
5. Type 4 isolator:
   a. Similar to ASHRAE Type 4 restrained spring isolator.
   b. Free-standing, laterally stable spring isolator.
   c. Provide resilient vertical limit restraints to prevent spring extension during weight changes.
      1) During normal operation, restraints shall not contact spring assembly. (Minimum clearance: 1/2 IN.
   d. Provide acoustical neoprene separator between spring(s) and base plate to prevent short circuiting through baseplate anchor bolts.
   e. Installed height shall equal operating height.
6. Type 5 thrust restraint:
   a. Similar to ASHRAE Type 5 thrust restraint.
   b. Same as Type 3 isolator for suspended supports except with angle-iron and rod attachments configured for mounting across flexible duct connection.

2.4 BASES

A. Bases:
   1. Type B, structural steel base:
      a. Rectangular in shape except for equipment which may require "T" or "L" shaped bases.
      b. Bases for split case pumps:
         1) Provide supports for suction and discharge base ells.
         2) Size base large enough to support base-ell supports.
      c. Perimeter members: Beams with a minimum depth equal to 0.10 of longest dimension of base.

d. Beam depth need not exceed 14 IN provided that deflection and misalignment is kept within acceptable limits as determined by manufacturer.
e. Provide height saving brackets in mounting locations to provide a base clearance of 1 IN.

2. Type C, concrete-filled, structural steel base:
   a. Rectangular structural beam or channel concrete forms for floating foundations.
   b. Minimum base depth: 0.083 of longest dimension of base, but not less than 6 IN.
   c. Base depth need not exceed 12 IN unless specially recommended by base manufacturer for mass or rigidity.
   d. Bases for split case pumps:
      1) Provide supports for suction and discharge base ells.
      2) Size base large enough to support base-ell supports.
   e. Provide minimum concrete reinforcement consisting of 1/2 IN bars or angles welded in place on 6 IN centers running both ways in a layer 1-1/2 IN above bottom, or additional steel as is required by structural conditions.
   f. Provide steel members to hold anchor-bolt sleeves when anchor bolts fall in concrete locations.
   g. Provide height saving brackets in mounting locations to maintain a 1 IN clearance below base.
3. Type D, curb mounted base:
   a. Factory assembled isolation base that fits over roof curb and under isolated equipment.
   b. Provide extruded aluminum top member to overlap bottom member to provide water run off independent of seal.
   c. Provide Type 3 isolators integral with base.
      1) Minimum deflection: 1.5 IN.
   d. Design shall allow springs to be inspected, serviced, and changed out while disturbing neither the roofing nor the unit.
   e. Provide resilient snubbers in corners with minimum clearance of 1/4 IN for wind resistance.
   f. Provide a weather seal of continuous closed cell sponge material both above and below base and a waterproof flexible duct-like EPDM connection joining outside perimeter of aluminum members.
   g. Foam or other contact seals are not acceptable at spring cavity closure.
4. Type IP, field assembled concrete base:
   a. Isolation bases:
      1) Field assembled concrete pads provided by Contractor.
      2) See Division 03 and structural drawings.

2.5 PIPING CONNECTIONS

A. Pipe Connections:
1. Flexible pipe connectors (FPC):
   a. Flexible neoprene/EPDM:
      1) Straight connectors: Twin sphere type.
      2) Elbow connectors: Single sphere type.
   b. Multiple plys of friction nylon tire cord with EPDM cover and liner.
   c. Do not use steel wire or rings as pressure reinforcement.
   d. Connectors:
      1) 2 IN NPS and smaller: Threaded or flanged ends.
      2) 2-1/2 IN NPS and larger: Floating galvanized steel flanges.
   e. Minimum pressure ratings:
      1) Twin spheres: 250 PSI at 170 degF and 165 PSI at 250 degF.
      2) Elbows and reducing twin spheres: 220 PSI at 170 degF and 145 PSI at 250 degF.
2. Flexible pipe hoses (FPH):
   a. Braided, stainless-steel type.
   b. Stainless steel braid: Type 321.
   c. Fittings: Carbon steel.

d. Connections:
   1) 2-1/2 IN NPS and smaller: Male nipples or copper sweat to match specified piping joints.
   2) 3 IN NPS and larger: Flanged.

e. Minimum transverse motion: ± 3/8 IN with no permanent misalignment.

PART 3 - EXECUTION

3.1 VIBRATION CONTROL

A. Install vibration control equipment in accordance with manufacturers installation instructions and as specified.

B. Select vibration control equipment as specified, and size in accordance with weight distribution, pull, and torque imposed by equipment being isolated.
   1. Base selection on equipment with Architect approved submittals.
   2. Minimum static deflections may be revised subject to prior approval.

C. Provide revised vibration control equipment to match revised or substituted equipment.

3.2 VIBRATION ISOLATORS, BASES, AND PIPING CONNECTIONS

A. Provide vibration isolators, bases, and piping connections as indicated in the following tables.
   1. Superscript numbers in parentheses refer to notes at the end of the tables.

MOUNTED ON GRADE SUPPORTED SLAB					
Equipment	Horsepower & Other	Isolator Type	Minimum Deflection	Base Type	Pipe Connection Type (1,4)
Air Handling Units With internal (blower) isolation	All	See Blowers/Fans			n/a
Air Handling Units With external (blower)isolation	All	3	0.75 IN	none	Note 14
Blowers/Fans (2,3) (SWSI, DWDI, Centrifugal, Utility)					
Up to 22 IN	All	2	0.25 IN	B	n/a
24 IN and Up					
301 to 500 RPM	Up to 40 HP	3 & 5	1.50 IN	B	n/a
Above 500 RPM	Up to 40 HP	3 & 5	0.75 IN	B	n/a
301 to 500 RPM	50 HP & Up	3 & 5	1.50 IN	C	n/a
Above 500 RPM	50 HP & Up	3 & 5	1.00 IN	C	n/a
Piping	All	4	1.50 IN	none	none
Pumps					
Close Coupled	Up to 7.5 HP	2	0.25 IN	B	FPC
	10 HP & Up	3	0.75 IN	B	FPC
Flex Coupled	Up to 40 HP	3	0.75 IN	B	FPC
	OVER 50 HP	3	0.75 IN	C	FPC
Large Inline	5 to 25 HP	3	0.75 IN	none	FPC
	30 HP & Up	3	0.75 IN	none	FPC
End Suction & Split Case	Up to 40 HP	3	0.75 IN	C	FPC
	50 to 125 HP	3	0.75 IN	C	FPC
	150 HP & Up	3	0.75 IN	C	FPC
Grouped On Base	All	1	0.30 IN	IP	FPC
Packaged Systems (8)	All	3	0.75 IN	C	FPC

MOUNTED ON STRUCTURAL FLOOR								
		21 TO 30 FT FLOOR SPAN			31 T0 40 FT FLOOR SPAN			Pipe
Equipment	Horsepower & Other	Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection	Base Type	Connection Type (1,4)
Air Handling Units With internal (blower) isolation	All	See Blower/Fans			See Blower/Fans			n/a
Air Handling Units With external (blower) isolation	All	3	1.50 IN	C	3	2.50 IN	C	Note 14
Blowers/Fans (2,3) (SWSI, DWDI, Centrifugal, Utility)								
Up to 22 IN	All	3 & 5	0.75 IN	B	3 & 5	1.50 IN	C	n/a
24 IN and Up								
301 to 500 RPM	Up to 40 HP	3 & 5	2.50 IN	B	3 & 5	2.50 IN	B	n/a
Above 500 RPM	Up to 40 HP	3 & 5	0.75 IN	B	3 & 5	1.50 IN	B	n/a
301 to 500 RPM	50 HP & Up	3 & 5	2.50 IN	C	3 & 5	2.50 IN	C	n/a
Above 500 RPM	50 HP & Up	3 & 5	1.50 IN	C	3 & 5	2.50 IN	C	n/a
Piping (9) First 3 supports from equipment connection	All	3	Note 11	none	3	Note 11	none	n/a
Remaining supports within 50 FT of equipment connection	All	3	0.75 IN	none	3	0.75 IN	none	n/a
Pumps								
Close Coupled	Up to 7.5 HP	3	0.75 IN	B	3	0.75 IN	C	FPC
	10 HP & Up	3	1.50 IN	B	3	1.50 IN	C	FPC
Flex Coupled	Up to 40 HP	3	1.50 IN	B	3	1.50 IN	C	FPC
	50 to 125 HP	3	1.50 IN	C	3	2.50 IN	C	FPC
	Over 125 HP	3	3.5 IN	C	-	-	-	-
Large Inline	5 to 25 HP	3	1.50 IN	none	3	1.50 IN	none	FPC
	30 HP & Up	3	1.50 IN	none	3	2.50 IN	none	FPC
End Suction & Split Case	Up to 40 HP	3	1.50 IN	C	3	1.50 IN	C	FPC
	50 to 125 HP	3	1.50 IN	C	3	2.50 IN	C	FPC
	150 HP & Up	3	2.50 IN	C	3	3.50 IN	C	FPC
Packaged Systems (8)	All	3	1.50 IN	C	3	2.50 IN	C	FPC

SUSPENDED FROM STRUCTURE								
		21 TO 30 FT FLOOR SPAN			31 T0 40 FT FLOOR SPAN			Pipe
Equipment	Horsepower & Other	Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection	Base Type	Connection Type (1,4)
Air Handling Units With internal (blower) isolation	All	See Blower/Fans			See Blowers/Fans			n/a
Air Handling Units With external (blower) isolation	All	3	1.50 IN	C	3	2.50 IN	C	Note 14
Blowers/Fans (2,3) (SWSI, DWDI, Centrifugal, Utility)								
Up to 22 IN	All	3 & 5	0.75 IN	B	3 & 5	1.50 IN	C	n/a
24 IN and Up								
301 to 500 RPM	Up to 40 HP	3 & 5	2.50 IN	B	3 & 5	2.50 IN	B	n/a
Above 500 RPM	Up to 40 HP	3 & 5	0.75 IN	B	3 & 5	1.50 IN	B	n/a
301 to 500 RPM	50 HP & Up	3 & 5	2.50 IN	C	3 & 5	2.50 IN	C	n/a
Above 500 RPM	50 HP & Up	3 & 5	1.50 IN	C	3 & 5	2.50 IN	C	n/a
Fans, Inline (2,3)	Up to 0.5 HP	3 or 3N	0.50 IN	none	3 or 3N	0.50 IN	none	n/a
	0.75 to 3 HP	3 or 3N	0.75 IN	none	3 or 3N	0.75 IN	none	n/a
	5 to 7.5 HP	3 or 3P & 5	1.50 IN	none	3 or 3P & 5	1.50 IN	none	n/a
	10 HP & Up	3 or 3P & 5	1.50 IN	none	3 or 3P & 5	2.50 IN	none	n/a
	10 HP & Up	3 or 3N & 5	1.50 IN	none	3 or 3N & 5	2.50 IN	none	n/a
Fans Coil Units	Up to 0.5 HP	2	0.50 IN	none	2	0.50 IN	none	FPC
	0.75 to 1.0 HP	3 or 3N	0.75 IN	none	3 or 3N	0.75 IN	none	FPC
	1.5 HP & Up	3 or 3P	0.75 IN	none	3 or 3P	1.50 IN	none	FPC
Piping (9) First 3 supports from equipment connection	All	3P	Note 11	none	3P	Note 11	none	n/a
Remaining supports within 50 FT of equipment connection								
Suspended Individually	Up to 3 IN	3N	0.75 IN	none	3N	0.75 IN	none	n/a
	4 IN & Up	3P	0.75 IN	none	3P	0.75 IN	none	n/a
Suspended on Trapeze	All	3P	1.50 IN	none	3P	1.50 IN	none	n/a
	All	3N	2.50 IN	none	3N	2.50 IN	none	n/a
Piping in Mechanical Rooms and Sensitive Areas (10,12,15)								
	Up to 3 IN	3N	0.75 IN	none	3N	0.75 IN	none	n/a
	4 to 6 IN	3P	1.50 IN	none	3P	1.50 IN	none	n/a
	8 IN & Up	3P	1.50 IN	none	3P	1.50 IN	none	n/a
	8 IN & Up	3N	2.50 IN	none	3N	2.50 IN	none	n/a
Piping at Plenum Penetrations	All	n/a	n/a	none	n/a	n/a	none	Note 14
Pumps								
Inline	Up to 2 HP	3 or 3N	0.75 IN	none	3 or 3N	0.75 IN	none	FPC
	3 to 5 HP	3 or 3P	1.50 IN	none	3 or 3P	1.50 IN	none	FPC
	7.5 HP & Up	3 or 3P	1.50 IN	none	3 or 3P	1.50 IN	none	FPC
	7.5 HP & Up	3 or 3N	2.50 IN	none	3 or 3N	2.50 IN	none	FPC

MOUNTED ON ROOF								
		21 TO 30 FT FLOOR SPAN			31 T0 40 FT FLOOR SPAN			Pipe
Equipment	Horsepower & Other	Isolator Type	Minimum Deflection	Base Type	Isolator Type	Minimum Deflection	Base Type	Connection Type (1,4)
Air Conditioning Units								
External	Less than 50 Tons	3	1.50 IN (13)	D & E	3	1.50 IN (13)	D & E	Note 14
Internal		locked out	---	B	locked out	---	B	n/a
External	50 Tons & Up	3	2.50 IN (13)	D & E	3	2.50 IN (13)	D & E	Note 14
Internal		locked out	---	B	locked out	---	B	n/a
Blowers/Fans								
Externally Isolated	Up to 5 HP	3	0.75 IN	E	3	0.75 IN	E	n/a
	7.5 HP & Up	3	1.50 IN	E	3	1.50 IN	E	n/a
Internally Isolated	Up to 10 HP	3	0.75 IN	E	3	1.50 IN	E	n/a

B. Notes to Tables:
1. Install piping connectors on equipment side of equipment isolation valves.
2. Size indicates diameter of wheel.
3. Provide Type 5 isolators on units operating at 2 IN or more static pressure.
   a. Mount one pair of isolators (on opposite sides) on each of fan's flexible connections.
   b. Adjust isolators to prevent flexible connections from extending to a tension condition.
   c. Attach isolators to duct at flanged joint through angle iron on back side of joint.
   d. See Section 23 31 13.
4. A swing joint with three flexible mechanical groove couplings may be substituted for an FPC.
5. Spring diameter: 2.50 IN.
6. Spring diameter: 4 IN.
7. Spring diameter: 6 IN.
8. On packaged systems, provide only external isolation.
9. Provide isolators on piping connected to vibrating equipment (i.e., equipment for which piping connections are specified).
10. Provide isolators for drainage and vent piping only if connected to vibrating equipment.
11. Same type as specified for equipment, except minimum deflection is 0.75 IN, and maximum deflection is 2.00 IN.
12. Mechanical rooms and sensitive areas:
    a. Mechanical rooms:
       1) Provide isolators for piping within mechanical rooms.
       2) Where isolators are indicated for piping connected to vibrating equipment, provide isolators which have the largest indicated minimum deflections.
13. Integral with base D.
14. Piping connection types:
    a. Water: FPC.
    b. Steam and refrigerant: FPH.

END OF SECTION

SECTION 20 05 53
MECHANICAL IDENTIFICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Mechanical Identification Systems, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Piping system identification:
   1. ASME/ANSI-A13.1, "Scheme for the Identification of Piping Systems".

1.3 SUBMITTALS

A. Product Data:
   1. Pipe markers.
   2. Valve tags.
   3. HVAC duct markers.
   4. Equipment name plates.
   5. Access panel markers.

B. Contract Closeout Information:
   1. Letter of transmittal indicating valve charts installed and delivered.
      a. Valve Chart: use “Spare Parts and Maintenance Material Transmittal” form per Section 01 78 43.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Mechanical Identification Systems:
   1. Pipe, valve and equipment markers:
      a. Base:
         1) Seton Name Plate.
      b. Optional:
         1) Brady, WH.
         2) EMED.
         3) Kolbi Industries.
         4) 3M.
         5) Craftmark Identification Systems.
         6) Marking Services, Inc.
         7) Carlton Industries.
         8) Brimar.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PIPE MARKERS

A. Conform to ASME/ANSI-A13.1.

B. Pressure sensitive vinyl (self-adhesive) material.

C. Mechanically fastened type: Snap on or strap on.

1. For dirty greasy, oily pipe where pressure sensitive markers may not perform satisfactorily.

D. Provide with arrows indicating direction of flow.

E. Letter sizes: In accordance with table in Part 3.

2.3 VALVE TAGS

A. Brass or anodized aluminum type.

B. Brass:
1. Minimum 19 gauge, polished, 1-1/2 IN diameter with following lettering:
   a. Service: 1/4 IN stamped black filled letters.
   b. Valve numbers: 1/2 IN stamped black filled letters.

C. Aluminum:
1. 2 IN diameter, 0.032 IN thick, with following lettering:
   a. Service: 1/4 IN engraved letters.
   b. Valve numbers: 1/2 IN engraved letters.

D. Valve tag fasteners:
1. 4 ply 0.018 IN copper or monel wire meter seals, brass "S" hooks or No.16 brass jack chain.

2.4 HVAC DUCT MARKERS

A. HVAC Duct Markers:
1. 1-1/2 IN black stenciled letters denoting system number (e.g., AHU-1, RF-3, EF-5), type (supply, return, exhaust) and flow direction.

2.5 EQUIPMENT NAME PLATES

A. Equipment name plates:
1. 1/16 IN rigid plastic, Setonply, Emedolite or bakelite with 4 edges beveled; or engraved aluminum with black enamel background and natural aluminum border and letters.
   a. Two 3/8 IN mounting holes.
   b. Lettering size: Minimum 1/2 IN high.

2.6 ACCESS PANEL MARKERS

A. Metal Tack Style:
1. Use on acoustical tile ceilings.
2. Seton style BCM or ECM.

B. Engraved Plastic Style.
1. 3/4 IN square with center hole for small screw.
2. Seton style CM75.

PART 3 - EXECUTION

3.1 VALVE IDENTIFICATION

A. Identify valves, with service designation and valve number designation on valve tags.
1. Tagging of valves at unit heaters, fan coil units, air terminal unit reheat coils and plumbing fixture stops are not required.
2. Install tags on valves using valve tag fasteners in manner for easy reading.

B. Label medical gas valves in accordance with NFPA-99.

C. Furnish 4 charts including valve identification number, location (room number, department) and purpose.
1. Mount 1 chart in frame and secure on wall in location directed by Owner.

2. Include remaining 3 sets in Operation and Maintenance Manuals.

3.2 PIPE IDENTIFICATION

A. Fire-protection and Sprinkler Piping.
   1. Painting not required in non-finished areas.

B. Identify piping systems with indicated lettering:

Drawing Symbol	Pipe Identification Lettering
CD	Condensate Drain
CPD	Condensate Pump Discharge
CW	Domestic Cold Water
CWR	Chilled Water Return
CWS	Chilled Water Supply
F	Fire Protection
GWR	Glycol Water Return
GWS	Glycol Water Supply
HPR	High Pressure Return (over 70 PSI)
HPS	High Pressure Steam (over 70 PSI)
HW(___)	Domestic Hot Water Supply (temperature)
HWC(___)	Domestic Hot Water Circulating (temperature)
HWR	Heating Hot Water Return
HWS	Heating Hot Water Supply
LPR	Low Pressure Steam Return (under 30 PSI)
LPS	Low Pressure Steam (under 30 PSI)
MPR	Medium Pressure Return (30-70 PSI)
MPS	Medium Pressure Steam (30-70 PSI)
NPW	Nonpotable Water
PR	Condensate Pump Return
S	Sprinklers
SCW	Soft Cold Water

C. Locate identification lettering as follows:
   1. Next to each valve and fitting, except on plumbing fixtures and equipment.
   2. At each branch or riser take off.
   3. At each passage through walls, floors and ceilings, both sides.
   4. At each pipe passage to underground.
   5. On horizontal pipe runs every 20 FT, at least once in each room and each story traversed by piping system.
   6. Identify piping contents, flow direction, supply and return.
   7. So it is readable from access panels and not obscured by other work.
   8. At least once in or above every room.

D. Size lettering, marker color fields, and arrows as follows:

IN	IN	IN
3/4 to 1-1/4	8	1/2
1-1/2 to 2	8	3/4
2-1/2 to 6	12	1-1/4
8 to 10	24	2-1/2
Over 10	32	3-1/2

E. Pipe Markers:
   1. Install markers with tape color bands over each end of marker, extending around pipe and overlapping a minimum of 30 degrees.

3.3 DUCTWORK IDENTIFICATION

A. Locate duct markers as follows:
   1. At each branch or riser take-off.
   2. Next to equipment.

B. Stencil ductwork or exterior surface of insulation.

3.4 EQUIPMENT IDENTIFICATION

A. Attach equipment nameplates in conspicuous location, directly on item of equipment or apparatus such as starters, pumps, fans, HVAC units and control panels.
   1. Secure nameplates with self-tapping screws, or nuts and bolts.

B. For unsuitable surfaces, such as high temperature or lack of space, use copper or brass rings or chains to attach tags.

C. Identify devices located above ceilings with additional identification.
   1. Use access panel markers (metal tack style) for acoustical tile ceilings, or engraved plastic style, 3/4 IN square, for mounting on panel door; or equipment nameplates.
   2. Coordinate with Owner on identification method and color codes.
   3. Provide markers on all removable ceilings and ceiling access panels to indicate locations of valves, dampers, smoke detectors, etc., and other mechanical items that may need servicing or adjustment. Glue marking tacks in place to prevent their falling out.
   4. Where fire protection devices are located inside ductwork, provide an additional tag on the duct access door identifying device inside.
      a. Identification letter size: 1-1/2 IN high minimum.
   5. Color code access panel markers as follows:
      a. Red: Fire dampers, smoke detectors, sprinkler shutoff valves and duct type smoke detectors.
         1) Notation:
            D - Damper
            V - Valve
            S - Smoke Detector
            H - Heat Detector
      b. Yellow: Steam, radiation, reheat and chilled water valves:
         1) Notation:
            V - Valve
      c. Gold: Automatic and balancing dampers:
         1) Notation:
            V - Valve
            D - Damper

END OF SECTION

SECTION 20 07 00

PIPE, DUCT AND EQUIPMENT INSULATION

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Pipe, Duct and Equipment Insulation, as indicated, in accordance with provisions of Contract Documents.

B. Insulation Applications:
   1. Pipe insulation.
   2. Duct insulation.
   3. Equipment insulation.
   4. Insulation jacketing and prefabricated fitting covers.
   5. Insulation fasteners: Adhesives, mastics, and caulking.
   6. Special Considerations at hangers and bracing: See Section 20 05 29 Penetrations and Supports.

C. Definitions:
   1. Concealed: Outside surfaces are isolated from room ambient air conditions by physical barrier.
      a. Concealed items are typically accessed through suspended ceilings, through access doors, or by cutting and patching.
      b. Listed below are examples of spaces that typically contain concealed items:
         1) Walls.
         2) Partitions.
         3) Chases.
         4) Shafts.
         5) Ceiling spaces.
   2. Exposed: Outside surfaces are not isolated from room ambient air conditions by physical barrier.
      a. Exposed items are typically accessed directly from within a room or space.
      b. Listed below are examples of rooms/spaces that typically contain exposed items:
         1) Mechanical rooms.
         2) Tunnels.
         3) Rooms without ceilings.
   3. Exposed to weather: Outside surfaces are not isolated by physical barrier(s) from weather or outside ambient air conditions.
   4. Runouts: Piping not more than 12 FT in length.
   5. Thermal conductivity (k): Btu/(h-ft-degF).
   6. Serviceable: strainers, steam traps, cleanouts.
   7. Non-Serviceable: fittings, valves.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Comply with the following fire and smoke hazard ratings:
   1. Test products by procedure ASTM E84, NFPA-255 and ANSI/UL-723.
   2. Rating requirements:
      a. Maximum Flame Spread: 25.
      b. Maximum Smoke Developed: 50.
   3. Properly identify products for flame and smoke ratings.
      a. Shipping cartons may be labeled instead of product.

B. Comply with requirements of the following:
   1. ASTM C547 Standard Specification for Mineral Fiber Preformed Pipe Insulation.
   2. ASTM C533 Standard Specification for Calcium Silicate Pipe and Block Insulation.
   3. ASTM C534 Standard Specification for Preformed Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form.
      a. Products are allowed to deviate from this standard with regard to insulation density.
   4. ASTM C552-00 Standard Specification for Cellular Glass Thermal Insulation.
   5. ASTM C553 Standard Specification for Mineral Fiber Blanket and Felt Insulation.
   6. ASTM C585 Recommended Practice for Inner and Outer Diameters of Rigid Pipe 'Insulation for Nominal Sizes of Pipe and Tubing (NPS System).
   7. ASTM C612 Standard Specification for Mineral Fiber Block and Board Thermal Insulation.
   8. ASTM C1136 Standard Specification for Flexible Low Permeance Vapor Retarders for Thermal Insulation.
   9. ASTM C795 Thermal Insulation for Use Over Austenitic Stainless Steel.
   10. Federal Specification HH-I-558B Mineral Fiber Boards, Blankets, Pipe Covering.
   11. National Commercial and Industrial Insulation Standards (2013 seventh edition).
      a. Published by Midwest Insulation Contractors Association (MICA).
      b. Endorsed by National Insulation Association (NIA).
      c. MICA plate numbers listed in this specification reference this document.

1.3 SUBMITTALS

A. Product Data:
   1. Pipe insulation.
   2. Precut insulation inserts.
   3. Ductwork insulation.
   4. Insulation for hot equipment.
   5. Insulation for high-temperature equipment.
   6. Insulation for cold equipment.
   7. Jacketing and prefabricated fitting covers.
   8. Insulation fasteners.
   9. Schedule of services and insulation thicknesses.
   10. Grooved coupling system insulation procedures and methods.

PART 2 - GENERAL

2.1 ACCEPTABLE MANUFACTURERS

A. Pipe, Duct and Equipment Insulation:
   1. Insulation materials:
      a. Base: As indicated.
      b. Optional:
         1) Owens-Corning Fiberglass.
         2) Armacell.
         3) Nomaco K-Flex.
         4) CertainTeed Insulations.
         5) Knauf Insulation.
         6) Johns Manville.
         7) Pittsburgh Corning.
   2. Jacketing:
      a. Base: As indicated.
      b. Optional:
         1) Ceel-Co.
         2) Childers Products.
         3) Johns Manville.
         4) Proto PVC Corporation.

5) RPR Metals.
6) Pabco Metals Corporation.

3. Prefabricated fitting covers:
   a. Base: As indicated.
   b. Optional:
      1) Ceel-Co.
      2) CertainTeed Insulations.
      3) Childers Products.
      4) Proto PVC Corporation.
      5) Johns Manville.
      6) RPR Metals.
      7) Pabco Metals Corporation.
4. Adhesives, mastics, caulkings, and finishes:
   a. Base: As indicated.
   b. Optional:
      1) Foster Products, Division of HB Fuller.
      2) Armacell.
      3) Childers Products.
      4) Dow Corning.
      5) Johns Manville.
      6) Knauf Insulation.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
   1. Do not use material that exceeds specified flame and smoke ratings.
   2. Use permanent treatments to jacketings and facings to impart specified fire ratings.
   3. Use of water soluble treatments is prohibited.

2.3 PIPE INSULATION - NON-FLEXIBLE FIBERGLASS

A. Preformed commercial-grade fiberglass.

B. Temperature range: 0 degF to 850 degF.

C. Thermal conductivity at mean temperature:
   1. k ≤ 0.23, 75 degF.
   2. k ≤ 0.29, 200 degF.
   3. k ≤ 0.54, 500 degF.

D. Facing: All service jacket.

E. Integral vapor retarder: Provide where indicated in Part 3.

F. Seams, longitudinal: 2 IN self-sealing facing tabs.
   1. Provide adhesive on both contacting surfaces.
   2. Designed to perform without stapling.

G. Pipe insulation, non-flexible; cellular glass:
   1. Material: Commercial-grade closed-cell inorganic glass insulation.
   2. Temperature range: -267 to 480 degC –450 to 900 degF.
   3. Minimum density: 120 kg/m3 7.5 PCF.
   4. Thermal conductivity at mean temperature:
      a. k ≤ 0.28, 50 degF.
      b. k ≤ 0.29, 75 degF.
   5. Fittings: Factory fabricated shapes designed for specific fittings.
   6. Base product: Pittsburgh Corning Foamglas.

2.4 PIPE INSULATION - FLEXIBLE

A. Commercial-grade closed-cell elastomeric or unicellular polyolefin thermal insulation.

B. Temperature range: 40 to 200 degF.

C. Thermal conductivity at mean temperature:
   1. k ≤ 0.27, 75 degF.
   2. k ≤ 0.276, 90 degF.

D. Seams, longitudinal: Factory-cut and self-sealing.
   1. Base product: AP Armaflex SS.

2.5 DUCTWORK INSULATION, NON-FLEXIBLE

A. Commercial-grade fiberglass thermal insulation formed with a thermosetting resin into semi-rigid or rigid boards.

B. Temperature range: 0 to 450 degF.

C. Minimum density:
   1. Semi-rigid: 3.0 PCF.
   2. Rigid: 6.0 PCF.

D. Thermal conductivity at mean temperature:
   1. Semi-rigid:
      a. k ≤ 0.22, 75 degF.
      b. k ≤ 0.27, 150 degF.
      c. k ≤ 0.38, 300 degF.
   2. Rigid:
      a. k ≤ 0.23, 75 degF.
      b. k ≤ 0.27, 150 degF.
      c. k ≤ 0.37, 300 degF.

E. Facing: All-Service-Jacket (ASJ).

F. Temperature range: -20 to 150 degF.

G. Base Products:
   1. Semi-Rigid: Owens-Corning Fiberglas Type 703.
   2. Rigid: Owens-Corning Fiberglas Type 705.

2.6 DUCTWORK INSULATION - FLEXIBLE

A. Interior Use:
   1. Commercial-grade fiberglass thermal insulation, formaldehyde free.
   2. Temperature range: 40 to 250 degF.
   3. Thermal conductivity at mean temperature: k ≤ 0.27, 75 degF.
   4. Installed R-value: . 5.6 HR-ft2-degF/BTU based on 2 IN nominal thickness.
   5. Density: 3 .75 PCF
   6. Facing: Foil-Reinforced-Kraft (FRK) vapor-retarding.
   7. Seams: 2 IN facing tab.
   8. Base product: Owens-Corning Fiberglass commercial-grade all-service duct wrap.

2.7 INSULATION FOR HOT EQUIPMENT

A. Same as Pipe Insulation - Nonflexible.

2.8 INSULATION FOR COLD EQUIPMENT

A. Material: Commercial-grade elastomeric thermal insulation.

B. Designed for application with complete adhesive coverage on systems operating at temperatures between -40 and 180 degF.

C. Thermal conductivity at mean temperature:
   1. k ≤ 0.27, 75 degF.
   2. k ≤ 0.276, 90 degF.

D. Base product: AP Armaflex sheet insulation.

2.9 JACKETING AND PREFABRICATED FITTING COVERS

A. General:
   1. Fitting Covers:
      a. Designed to fit over precut insulation inserts.
      b. Designed specifically for fitting being covered.
      c. 2-gore covers are not acceptable.

B. Jacketing and Fitting Covers:
   1. High impact PVC.
   2. Minimum 0.028 IN thick.
   3. Resistant to bacterial growth, mildew, and corrosion.
   4. Minimum 25 mm 1 IN overlap at joints.
   5. Base manufacturer: Johns Manville Zeston 2000 series.

C. Metal Jacketing and Fitting Covers:
   1. Material: As indicated in Part 3.
   2. On cold systems and equipment, provide factory moisture barrier.
   3. Attaching method:
      a. 0.020 x 3/8 IN bands on 9 IN centers unless indicated otherwise in Part 3.
      b. Band material: Same as jacketing and covers.
   4. Minimum 2 IN overlap at joints.
   5. Tubular jacketing: Locking longitudinal seams.
   6. Base manufacturer: Childers.

2.10 INSULATION FASTENERS

A. Insulation Adhesive:
   1. Flexible pipe insulation: Manufacturers standard adhesive as approved for application.
   2. Childers CP-82.
   3. Foster 30-36.
   4. Foster Spark-Fas 85-70.

B. Insulation Mastic:
   1. Childers CP-30.
   2. Foster 35-00-GPM.

C. Insulation Caulking:
   1. Dow No.11.

PART 3 - GENERAL

3.1 APPLICATION

A. General:
   1. Apply products per manufacturer's recommendations and as specified.
      a. Include allowance for thermal expansion and contraction.
   2. MICA plate numbers are listed under some insulation applications to clarify scope and acceptable methods of insulation application for particular listing.
   3. Do not insulate piping until satisfactory completion of required pressure tests.
   4. Do not insulate piping below grade.
      a. Specific exceptions may exist under Pipe Insulation - Flexible.
   5. Apply insulation to clean, dry surfaces and within manufacturers recommended temperature range.

6. Butt edges of insulation firmly together, and seal joints with compatible jackets, facings and adhesives as specified.
7. Apply insulation with a continuous, unbroken vapor retarder including, but not limited to, insulation of following.
    a. Vapor seals on hangers, supports, and anchors secured directly to cold surfaces.
8. Continue insulation through sleeves and wall and ceiling openings.
9. Insulate fittings, unions, valve bodies, flanges and other pipeline accessories.
10. Insulation at piping supports: Coordinate with Section 20 05 29.
11. Insulation installed in multiple layers: Stagger joints between layers.

3.2 PIPE INSULATION - NONFLEXIBLE FIBERGLASS

A. General:
1. Provide either type of lap seal at joints:
    a. Self-sealing facing tabs.
    b. 3 IN wide pressure-sensitive joint-sealing tape matching facing.
        1) Manufacturer: Same as insulation.
    c. Insulation application standard: MICA plate number 1-100.
    d. Insulation application for heat traced piping standard: MICA plate number 1-900.
2. Fittings:
    a. On non-serviceable items, use either of the following methods:
        1) Built-up systems:
            a) Elbows: MICA plate numbers 2-100 through 2-800 as applicable.
            b) Valves and fittings: MICA plate number 2-530 or 2-536 as applicable.
            c) Flanges: MICA plate number 2-535.
            d) Tees: MICA plate number 2-120.
        2) Prefabricated fitting cover encapsulated:
            a) Elbows: MICA plate number 2-500.
            b) Valves and fittings: MICA plate number 2-130.
            c) Flange or grooved coupling: MICA plate number 2-535.
    b. Serviceable items: Provide prefabricated fitting covers attached with bands.
        1) Exception: On systems exposed to weather, attach with method described as best by manufacturer.
    c. Exposed fittings, flanges, valves, and pipe terminations: Provide prefabricated fitting covers.
    d. Built-up system:
        1) DN50 2 IN and smaller: Finish with mineral fiber cement to thickness of adjoining pipe insulation.
        2) DN65 2-1/2 IN and larger: Insulate with insulation insert, mitered pipe insulation segments or preformed fiberglass fittings.
            a) Secure with vinyl faced insulation strapping tape or 20 AWG galvanized annealed wire finished with one coat of mineral fiber cement.
        3) Finish with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

B. Provide non-flexible insulation on following piping systems in wall thickness indicated:
1. Hydronic systems:
    a. Chilled water piping, with or without glycol, 40 to 55 degF:
        1) DN20 3/4 IN and smaller: 1/2 IN.
        2) DN25 1 IN to DN30 1-1/4 IN: 1 IN.
        3) DN40 1-1/2 IN and greater: 1-1/2 IN.
    b. Heating water piping, with or without glycol to 200 degF:
        1) DN32 1-1/4 IN and smaller: 1-1/2 IN.
        2) DN40 1-1/2 IN and greater: 2 IN.
2. Plumbing systems:
    a. Domestic cold water piping:
        1) DN40 1-1/2 IN and smaller: 1 IN.
        2) DN50 2 IN and greater: 1-1/2 IN.

b. Domestic hot/recirculating water, 100 to 140 degF:
   1) DN32 1-1/4 IN and smaller: 1 IN.
   2) DN40 1-1/2 IN and greater: 1-1/2 IN.
c. Domestic hot/recirculating water 141 to180 degF:
   1) DN32 1-1/4 IN and smaller: 1-1/2 IN.
   2) DN40 1-1/2 IN and greater: 2 IN.
d. Horizontal rain leaders including overflow systems and 24 IN up and down from horizontal and up to underside of roof deck:
   1) All sizes: 1 IN.
   2) Rain leaders are cold systems.

3. Low pressure steam and steam condensate piping, 15 PSI or less, pumped condensate return, condensate vent, blowdown, boiler feed, and exhaust steam piping:
   a. DN75 3 IN and smaller: 2-1/2 IN.
   b. DN100 4 IN and larger: 3 IN.
4. Steam and steam condensate piping, 16 PSI to 100 PSI:
   a. DN20 3/4 IN and smaller: 3 IN.
   b. DN25 1 IN and larger: 4-1/2 IN.
5. Steam and steam condensate piping greater than 100 PSI:
   1) DN20 3/4 IN and smaller: 4-1/2 IN.
   2) DN25 1 IN and larger: 5 IN.

C. Piping Within Air Handling Units:
1. Flame-resistant, aluminum-faced, vapor retarder jacket over non-flexible insulation on steam, condensate-return, heating-water, and chilled-water piping inside air handling units.
2. Extend vapor retarder jacket outside of unit enclosure.
3. Cover joints with 3 IN wide pressure sensitive tape matching jacket.

3.3 PIPE INSULATION - NONFLEXIBLE CELLULAR GLASS

A. General:
1. Install using system components and methods recommended by manufacturer for service temperature of piping system.
2. Provide non-flexible insulation on following piping systems in wall thickness indicated:
   a. Hydronic systems (Provide only for the following in the basement when piping are within the finished floor and 3’ above finished floor in elevation):
      1) Low pressure steam and steam condensate piping, 15 PSI or less, pumped condensate return, condensate vent, blowdown, boiler feed, and exhaust steam piping:
         a) DN75 3 IN and smaller: 2-1/2 IN.
         b) DN100 4 IN and larger: 3 IN.
      2) Heating water piping, with or without glycol to 200 degF:
         a) DN32 1-1/4 IN and smaller: 1-1/2 IN.
         b) DN40 1-1/2 IN and greater: 2 IN.
      3) Chilled water piping, with or without glycol 40 to 55 degF in the basement from :
         a) DN40 1-1/4 IN and smaller: 1 IN.
         b) DN50 1-1/2 IN and greater: 1-1/2 IN.

3.4 PIPE INSULATION - FLEXIBLE

A. General:
1. Install insulation sleeve over piping.
2. Do not make longitudinal field cuts.
3. Seal joints with manufacturer approved adhesive.
4. Do not use flexible pipe insulation on systems with heat tracing cable or temperature maintenance cable.

B. Fittings:
1. Insulate fittings and valve bodies with segments cut from pipe insulation.

C. Provide flexible insulation on following piping systems in wall thickness indicated:
   1. Hydronic systems:
      a. Cooling coil condensate:
         1) All sizes: 1 IN.
   2. Refrigerant systems:
      a. Refrigerant/brine piping:
         1) DN32 1-1/4 IN and smaller: 1 IN.
         2) DN40 1-1/2 IN and larger: 1-1/2 IN.

3.5 DUCTWORK INSULATION - NONFLEXIBLE

A. General:
   1. Secure insulation to ductwork by impaling over welded-pin or adhesive-pin mechanical fasteners.
      a. Secure insulation on mechanical fasteners with speed clips.
      b. Space mechanical fasteners to hold insulation securely in place.
         1) Maximum spacing: 12 IN centers.
   2. Where access is not possible for pin attachment, use adhesive or caulk.
      a. Cover entire surface with brush applied adhesive.
      b. Apply caulk in continuous bead on 6 IN centers.
   3. Seal joints and speed clips with 3 IN wide pressure-sensitive joint-sealing tape matching facing.
      a. Staple corners of tape with outward clinching staples.
   4. Cold systems only: Coat staples with mastic.
   5. Reinforce edges with metal corner angles.
   6. Apply insulation to ductwork from unit housing to ends of duct runs including diffuser necks and register ducts.
   7. Do not apply insulation over coil and damper access panels.
   8. Do not apply insulation over internally lined ductwork: Coordinate with Section 23 31 13.
   9. Use FRK facing on concealed ductwork.
   10. Use ASJ facing on exposed ductwork.

B. Provide non-flexible insulation on following ductwork in thickness indicated:
   1. Outside-air rectangular ductwork:
      a. All sizes: 2 IN.
   2. Relief-air/exhaust-air plenums behind louvers or below gravity and powered roof ventilators:
      a. All sizes: 2 IN.
   3. Return ductwork for the first 30’ from the Air Handling Unit.
      a. All sizes: 1-1/2” IN.

3.6 DUCTWORK INSULATION - FLEXIBLE

A. General:
   1. On ductwork 24 IN wide and less, secure insulation to bottom of ductwork with 4 IN wide bands of brush-applied adhesive on 12 IN centers.
   2. On ductwork over 24 IN wide, secure insulation to bottom of ductwork by impaling over welded-pin or adhesive-pin mechanical fasteners.
      a. Secure insulation on mechanical fasteners with speed clips.
      b. Space mechanical fasteners to hold insulation securely in place.
         1) Maximum spacing: 12 IN centers.
      c. Seal speed clips with 3 IN wide pressure-sensitive joint-sealing tape matching jacket.
         1) Staple corners of tape with outward clinching staples.
         2) Cold systems only: Seal staples with mastic.
   3. Provide either type of lap seal at joints:
      a. Seal facing tab over adjoining facing with lap adhesive.
         1) Secure lap with outward clinching staples on 6 IN centers.
      b. Use 3 IN wide pressure-sensitive joint-sealing tape that matches facing.

1) Secure both sides of tape with outward clinching staples on 6 IN centers.
c. Cold systems only: Seal staples with mastic.
4. Apply insulation to ductwork from unit housing to ends of duct runs, including diffuser necks and register ducts.
5. Do not apply insulation over coil and damper access panels.
6. Do not apply over internally lined ductwork: Coordinate with Section 23 31 13.

B. Provide flexible insulation on following ductwork in thickness indicated:
1. Outside-air round ductwork:
a. All sizes: 3 IN; minimum installed R-value of 8.0.
2. Supply-air ductwork, including downstream of terminal units, sound attenuators, reheat coil casings and tube ends, except where specified to be internally lined or specified to be covered by nonflexible insulation:
a. All sizes: 2-1/8 IN; minimum installed R-value of 6.0.
3. Return-air ductwork in non air conditioned areas (including utility shafts):
a. All sizes: 2-1/8 IN; minimum installed R-value of 6.0.
b. Ceiling spaces directly above conditioned spaces are considered conditioned.
4. Return-air, relief-air, and exhaust air ductwork from relief plenum at louver, or other outside opening, back to relief-air damper plus 36 IN or a minimum of 10 FT upstream of plenum, louver or other outside air opening:
a. All sizes: 2-1/8 IN; minimum installed R-value of 6.0.
5. Return-air or exhaust ductwork passing through outside-air plenums (shafts, ductwork, tunnels, etc.):
a. All sizes: 2 IN; minimum installed R-value of 5.0.
6. Exhaust-air ductwork from exhaust plenum at louver (or other outside opening) back to exhaust-air damper (motorized or gravity) plus 915 mm 36 IN:
a. All sizes: 2 IN; minimum installed R-value of 5.0.

3.7 INSULATION - HOT EQUIPMENT

A. General:
1. Secure insulation to bottom of flat surfaces wider than 24 IN by impaling over adhesive-pin mechanical fasteners.
a. Secure insulation on mechanical fasteners with speed clips.
b. Space mechanical fasteners to hold insulation securely in place.
1) Maximum spacing: 12 IN centers.
2. Seal joints and speed clips with 3 IN wide pressure-sensitive joint-sealing tape that matches facing.
a. Secure both sides of tape with outward clinching staples on 3 IN centers, 5 mm 1/4 IN from edge.
3. Insulate flanges and fittings as indicated under Pipe Insulation, Nonflexible.
4. Reinforce ends and irregular surfaces with Glass Fab embedded in 2 coats of Foster 30-36 adhesive.

B. Provide hot-equipment insulation on following equipment in thickness indicated:
1. Air separators: 2 IN.
a. Insulation assembly standard: MICA plate number 4-100 or 4-120.
2. Condensate receivers above grade: 2 IN.
3. Steam-to-water heat exchangers: 2 IN.
a. Insulation assembly standard: MICA plate number 4-130.

3.8 INSULATION - COLD EQUIPMENT

A. Apply insulation with adhesive and coatings approved by manufacturer.
1. Completely cover joining surfaces (equipment surfaces, and back and butting edges of insulation).
2. Apply with 1/8 IN overlay pressure on butt joints.
3. Apply 2 coats of white latex enamel to outside layer.

B. Provide cold-equipment insulation on following equipment in number of layers and total thickness indicated:
   1. Roof drain bodies: 1 layer, 20 mm 3/4 IN.

3.9 JACKETING AND PREFABRICATED FITTING COVERS

A. General:
   1. Stagger jacketing and insulation joints.

B. Systems exposed to weather:
   1. Material:
      a. 0.016 IN smooth aluminum.
   2. Attach as recommended by manufacturer.
   3. Joints:
      a. Orient joint laps to prevent entry of water.
      b. Seal joints weather tight.

C. Hot Equipment:
   1. Material:
      a. 0.016 IN smooth aluminum.
   2. Attach as recommended by manufacturer.

D. High-temperature equipment:
   1. Material:
      a. 0.010 IN smooth stainless steel.
   2. Attach with stainless-steel screws or 0.020 IN x 3/4 IN stainless steel bands on 8 IN centers.

END OF SECTION

SECTION 20 08 00
TESTING AND BALANCING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Testing and Balancing, as indicated, in accordance with provisions of Contract Documents.

B. Test, balance and adjust following mechanical systems:
   1. Air distribution systems.
   2. Air handling units and air moving equipment.
   3. Heating hot water systems including pumps.
   4. Chilled water systems including pumps.
   5. Heating and cooling coils.
   6. Existing air distribution systems affected by new installation.
   7. Existing hydronic systems affected by new installation.
   8. Temperature Controls:
      a. Assist Temperature Controls installer with calibration of air and waterside control components such as airflow stations, flow meters, etc as outlined in Section 25 50 00.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Agency qualifications: Independent test and balance agency, member of Associated Air Balance Council (AABC), or National Environmental Balancing Bureau (NEBB).
   1. Work supervised by a certified Testing and Balancing Engineer.
   2. Indicate at least 5 successfully completed projects of similar size and scope.

B. Testing and balancing standards: AABC or NEBB standards and procedures.

1.3 RESPONSIBILITIES OF TESTING AND BALANCING (TAB) AGENCY

A. Review contract document ductwork drawings before bid and advise 23 31 13 contractor as to the number and size of additional branch main volume dampers required to facilitate balancing.

B. In accordance with 23 31 13, review contractor ductwork installation drawings before fabrication and advise where additional volume dampers are required to facilitate balancing.

C. Schedule work with trades involved.

D. Check, adjust, and balance system components to obtain optimum conditions for function and operation of system.

E. Evaluate operation of systems and advise installer of necessary adjustments and corrective measures.

F. Prepare and submit test reports.
   1. Submit to Owner and to Contractor for Submittal to Architect.

1.4 RESPONSIBILITIES OF MECHANICAL INSTALLER

A. Coordinate and schedule with testing agency.

B. Start up system and keep in correct operation during balancing operations.

C. Provide necessary adjustments and corrections to systems as directed by Testing and Balancing Agency.

D. Maintain accessibility to test locations and devices requiring adjustment.

E. Provide additional sets of pulleys and belts as required by Testing and Balancing Agency.

F. Provide a complete set of approved mechanical-equipment shop drawings to Testing and Balancing Agency.

G. Provide a complete set of "As-built" drawings to Testing and Balancing Agency.

1.5 JOB CONDITIONS

A. Balance at time directed by Architect.
   1. If balancing is not done during peak cooling season demonstrate satisfactory balancing during next peak cooling season.

B. Keep dust, dirt and debris to an absolute minimum and reinstall removed ceiling tiles to original positions at end of each work day.

1.6 CORRECTIVE WORK

A. Provide extended warranty of ninety (90) days, after completion of test and balance work, during which time Architect may, at Architect's discretion, request recheck or resetting of equipment or system which is not performing satisfactorily. Provide technicians to assist as required in making such tests.

1.7 SUBMITTALS

A. Project Information:
   1. Within sixty (60) days of award of contract submit a complete Submission Report including:
      a. A company resume listing its personnel and project experience in air and hydronic balancing.
      b. An inventory and calibration data of instruments and devices in possession of balancing agency whether or not they will be used on this project.
      c. A working agenda that includes procedures for testing and balancing each air and water flow system.
      d. Test and Balance Report Forms and Field Data Sheets that will appear in final report, with design data already filled in.
      e. A written, system-by-system description of measurements, test locations and procedures that will be employed during test and balance.

B. Contract Closeout Information:
   1. Final test and balance report:
      a. Use forms similar to AABC or NEBB latest editions.
      b. Report(s) signed by TAB Engineer.

PART 2 - PRODUCTS

2.1 JOB SITE INSPECTIONS

A. During construction inspect installation of piping, sheet metal work, temperature controls, flow meters, pressure taps, strainers and other components of HVAC system as specified in contract documents.

B. Note any deficiencies and submit them, in writing, to Architect.
   1. Include these inspection reports in final TAB report.

2.2 FINAL TEST AND BALANCE REPORT

A. Using field data, test forms and procedures outlined in Submission Report, perform and record measurements, and complete final TAB report including:
   1. Preface:

a. General discussion of system including any abnormalities and problems encountered.

2. Instrumentation list:
   a. List of instruments including type, model, manufacturer, serial number and calibration date.
3. System identification:
   a. On each Test and Balance Report Form, number and/ or letter air terminal units, zones, supply, return and exhaust openings and traverse points to correspond to numbers and letters on Field Data Sheets.
4. Air handling equipment:
   a. Manufacturer, model number, and serial number.
   b. Design and manufacturer related data.
   c. Total actual air flow rate by traverse if practical; if not practical, sum of outlets may be used, or a combination of each of these procedures.
      1) For specific systems, such as ones with diversity, see AABC National Standards.
   d. Suction and discharge static pressure of each fan, as applicable.
   e. Outside air and return air total air flow rate including their damper positions.
   f. Actual operating current, voltage, and brake power of each fan motor.
   g. Final RPM of each fan.
   h. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
   i. Belt size and quantity.
   j. Air Pressure drop across each filter bank and air blender.
   k. Static pressure controls final operation set points.
5. Exhaust Fans:
   a. Manufacturer, model number, and serial number.
   b. Design and manufacturer related data.
   c. Total actual air flow rate by traverse.
      1) For specific systems, such as ones with diversity, see AABC National Standards.
   d. Suction and discharge static pressure of each fan, as applicable.
   e. Actual operating current, voltage, and brake power of each fan motor.
   f. Final RPM of each fan.
   g. Fan and motor sheave manufacturer, model, size, number of grooves and center distance.
   h. Belt size and quantity.
6. Pumps:
   a. Manufacturer, size, and serial number.
   b. Design and manufacturer's related data.
   c. Pump operating suction and discharge pressures, and final total dynamic head.
   d. No-flow (pump discharge valve closed) suction and discharge pressures, and corresponding total dynamic head. (This procedure is to determine actual impeller size.)
   e. Rated and actual operating current, voltage and brake power of each pump motor.
   f. Submit pump curve indicating design, operating, and no-flow points of operation.
7. Heat exchangers:
   a. Manufacturer and model number.
   b. Design and manufacturer's related data.
   c. Service and location.
   d. Actual pressure drop and related water flow rate or steam pressure, primary side.
   e. Actual pressure drop and related water flow rate or steam pressure, secondary side.
   f. Primary side entering steam pressure.
   g. Secondary side entering and leaving temperatures.
   h. Temperature control setting.
8. AHU Heating and cooling coils:
   a. Manufacturer.
   b. Design and manufacturer's related data.
   c. Rated and actual water pressure drops through each coil and related water flow rate.
   d. Rated and actual static air pressure drops across each coil.

e. Entering and leaving water temperatures.
f. Wet bulb and dry bulb temperatures entering and leaving each cooling coil.
g. Dry bulb temperatures entering and leaving each heating coil.
h. Water flow rate from flow stations or steam pressure.
i. Calibrated autoflow/balancing valve readings.

9. Terminal Box Heating coils:
   a. Manufacturer.
   b. Design and manufacturer's related data.
   c. Rated and actual water pressure drops through each coil and related water flow rate.
   d. Rated and actual static air pressure drops across each coil.
   e. Entering and leaving water temperatures.
   f. Dry bulb temperatures entering and leaving each heating coil.
   g. Water flow rate from flow stations.
10. Air terminal units, diffusers, registers and grilles:
   a. Adjust air terminal units to deliver design maximum and minimum air-flow conditions.
   b. Flow rate at each air outlet (diffuser) at maximum and minimum airflow.
   c. Flow rate at each return and exhaust air inlet (register or grille).

B. Units of measure:
   1. Flow rates:
      a. Air: .
      b. Water: ____ GPM.
   2. Temperatures: ____ degF.
   3. Pressures:
      a. Air: ____ IN WC.
      b. Steam: ____PSIG.
      c. Water: ____ PSIG.
   4. Pump heads: ____ FT.
   5. Power: ____ HP.

PART 3 - EXECUTION

3.1 GENERAL

A. Final reports are required to be completed and submitted far enough in advance of local agencies final inspections for occupancy to provide adequate time for Engineer to review, Contractor to correct any deficiencies and reports to be revised for agencies final inspections.

B. Coordinate and schedule testing and balancing with Contractor and Mechanical Contractor.
   1. Report deficiencies in systems to Mechanical Contractor for resolution.

C. Accurately calibrate and maintain test instruments in good working order.
   1. If requested, conduct tests of instruments in presence of Engineer.

D. Conduct balancing tests in presence of Engineer at the time of Validation Testing as listed in specification 25 50 00.

E. Do not begin balancing until system(s) have been substantially completed and are in good working order to permit preliminary measurements of total air or water volumes and system pressures.

F. Proceed with final balancing and adjustments when systems are 95 to 100 percent complete.

G. Record inspections, tests and adjustments.

H. Supply, Return, and Exhaust systems are to be balanced after each phase of construction and reports submitted. Where supply, return, or exhaust ductwork serves multiple phases or where a duct main serving a phase changes, the previous phase supply, return, and exhaust systems shall be rebalanced or previous balance confirmed as appropriate, Test and balance reports shall be generated at the end of each phase.

I. Where existing areas, outside the area of construction, are affected by the work in a given phase, perform preliminary testing of ductwork mains serving the affected areas; rebalance the affected mains to the preliminary values at the completion of the phased work.

3.2 AIR BALANCING METHODS

A. Balance each air system that is served by air filters, using artificial static loading of system, to demonstrate, test and obtain system design pressure drop data.
   1. Provide dirty filter pressure drop conditions on system.
   2. Do not use high efficiency filters (75 percent and above) in testing and balancing.
   3. Static pressure losses may be simulated by using wood or sheet steel blanking plates in high efficiency filter racks and housings.
   4. Do not install blanking plates within 2 FT of low efficiency filter unit or rack.

3.3 AIR BALANCE TESTING PROCEDURE

A. Perform tests and balance system in accordance with approved Submission Report.

B. Take readings of airflow stations if installed or make pitot tube traverse of main supply, return and exhaust air ducts.
   1. Obtain flow rates at fans at both maximum and minimum outside air operation.

C. Test and adjust each diffuser, grille, and register served by an air terminal unit to within 10 percent of design requirements.

D. At minimum and maximum airflow rates, provide supplemental readings of static pressure, supply fan and return fan speeds, return damper position, relief damper position, and outdoor air damper position, static pressure readings, supply airflow rate, return airflow rate, and outdoor air airflow rate..

E. In cooperation with HVAC Controls installer, set automatically operated dampers to operate as indicated.
   1. Check controls for proper calibration and list controls requiring adjustment.

3.4 WATER BALANCE TESTING PROCEDURE

A. Complete air balancing before commencing water balancing.

B. Test and adjust each autoflow and manual balancing valve to design requirements. At full design flow, provide pump speed, flow rate, pump inlet and outlet pressure readings, and differential set point.

C. Balance all domestic hot water recirculation valves to designed values.

D. Perform test and balance systems in accordance with approved Submission Report.

3.5 OPERATING TEST

A. After systems are balanced, conduct operating test of not less than 8 hours duration to demonstrate to satisfaction of Architect that system(s) comply with requirements of plans and specifications, and that equipment and controls are functioning properly.

END OF SECTION

SECTION 20 11 00
PIPE AND FITTINGS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Pipe and Fittings, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Pressurized piping.
   2. Nonpressurized piping.
   3. Accessories:
      a. Dielectric fittings.
      b. Unions.

C. This specification lists a variety of piping that may be applicable to the project. Not all piping and fittings listed are applicable to the project, refer to appropriate spec sections for project applicability.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Pipe and fittings to be ASTM labeled for rating specified.

B. Pipe and fittings to be marked with the collective trademark of the Cast Iron Soil Pipe Institute and be listed NSF International.

C. Welder qualifications: Certified under requirements of ANSI/ASME-B31.1 Power Piping.

1.3 SUBMITTALS

A. Project Closeout Information:
   1. Manufacturer of listed products.
   2. Pre-insulated conduit piping system test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Cast Iron Pipe.
   1. Base:
      a. Tyler.
   2. Optional:
      a. AB&I.
      b. Charlotte Pipe.

B. Fittings, Mechanical Groove-end and Plain-end Pipe:
   1. Base:
      a. Victaulic Company of America.
   2. Optional:
      a. Anvil International, Inc.
      b. Grinnell.

C. Fittings, Ring Seal Crimped Copper:
   1. Base:

a. Viega.
2. Optional:
a. Nibco.
b. Apollo.

D. Dielectric Waterway Fittings:
1. Base:
a. Perfection Corp. Victaulic Company of America.
b. Grinnell.
c. Victaulic.

E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 PIPE

A. Black Steel Pipe:
1. Seamless or welded steel pipe, ASTM-A53, standard weight unless otherwise indicated.
2. For fire sprinkler service:
a. The following Testing Standards and listed grades are acceptable:
1) ASTM-A135, Grade B
2) ASTM-A53, Grade B.
3) ASTM- A795, Grade B.
b. Weight: Schedule-40 unless otherwise indicated.

B. Galvanized Steel Pipe:
1. Seamless or welded, hot-dipped galvanized steel pipe, ASTM-A53 or ASTM-B36.
2. Joints:
a. Threaded.
b. Welded.
c. Cut or rolled grooved.

C. Copper Pipe:
1. Seamless copper tubing, ASTM B88, Type-K, Type-L, or Type-M as indicated.
2. Joints:
a. Soldered: Use ASTM B32, 95 percent tin, 5 percent antimony solder, or Silvabrite 100.
b. High temperature soldered: Use 1,000 degF solder.
c. Roll grooved.
d. Ring seal crimped, where specified and permitted by authority having jurisdiction.
3. 400 PSI fittings: Heavy wall type, Mueller "Steamline".
4. 400 PSI fittings: Heavy wall type, Mueller "Steamline".

D. Cast Iron Soil Pipe:
1. ASTM A74.
2. Bell and spigot joints: Use oakum and lead, or neoprene gaskets when allowed by code.
3. Gaskets: ASTM C564.
4. Bear the collective trademark of the Cast Iron Soil Pipe Institute and be listed NSF International.

E. No Hub Cast Iron Pipe:
1. CISPI 301 or ASTM A888.
2. Mechanical joints:
a. Conform to ASTM C1540: Join hubless pipe and fittings with heavy duty stainless steel couplings with neoprene gaskets.
b. Approved manufacturers: Husky SD 4000, Clamp All 125 or MG Couplings.
3. Gaskets: ASTM C564.
4. Bear Cast Iron Soil Pipe Institute trademarkand NSF International listed.

F. Cast Iron pressure pipe:
1. ANSI/AWWA-C105/A21.5, lined and coated.
2. Thickness class: 22.

a. Exception: When depth of cover exceeds 8 FT, use thickness class 23.
3. Joints: Use mechanical or push-on joints below grade.
4. Mechanical or push-on joints for water: ANSI/AWWA-C111/A21.11.
5. Mechanical joints for fuel gas piping: ANSI-B31.2.
6. Gaskets: Suitably formed of high quality vulcanized rubber, made to exact dimensions, and in form of a solid ring, with durometer hardness of approximately 85; for joint rating of 350 PSI internal liquid pressure, minimum.

G. Shop Coating and Lining for ductile and cast iron pipe:
1. Cement lining: ANSI/AWWA-C104/A21.4, except lining thickness may be reduced to 0.5 ANSI specified thickness for "Enameling" coating.
2. Rust preventative: Non-Ox-Id 558.
3. Bituminous coating: Manufacturer's standard, minimum 1 mil thick.
4. Provide interior surfaces of ductile iron and cast iron pipe and fittings with cement lining.
5. Shop coat flange faces with rust preventative compound.
6. Shop coat other surfaces of ductile iron and cast iron pipe and fittings with bituminous coating.

2.3 FITTINGS AND COUPLINGS

A. Steel Pipe Fittings:
1. Socket welding fittings: ANSI/ASME-B16.11 and ASTM A234.
2. Butt welding fittings: ANSI/ASME-B16.9, ANSI/ ASME-B16.25 and ASTM A105.
3. Grooved fittings: Square cut, ASTM-A53 steel, or roll grooved, ASTM A135.
4. Flanged fittings: ANSI/ASME-B16.5 and ASTM A105.
5. Flange bolts: ASTM A193 Grade B7.
6. Gaskets: Spiral wound metallic.

B. Malleable Iron Pipe Fittings:
1. Threaded fittings: ANSI/ASME-B1.20.1 and ANSI/ASME-B16.3, Class 150.
2. Threaded couplings: Same as threaded fittings except Class 300.
3. Grooved couplings: ASTM A47, coupling segments with EPDM Grade-E gasket.
4. Galvanized malleable iron couplings: Victaulic; or ITT Grinnell.

C. Cast Iron Pipe Fittings:
1. Drainage fittings: Coated or galvanized, ASTM A74.
2. Threaded fittings: ANSI/ASME-B1.20.1 and ANSI/ASME-B16.4, Class 125.
3. Threaded drainage fittings: ANSI/ASME-B1.20.1, ANSI/ASME-B16.12 and ASTM A126.
4. Flanged: ANSI/ASME-B16.1, Class 125.

D. Copper Pipe Fittings:
1. Wrought copper fittings: ANSI/ASME-B16.22.
2. Cast brass fittings: ANSI-B16.18.
3. Mechanical groove-end fittings: Factory roll grooved.
4. Flared tubing fittings: Use only on annealed pipe.
5. Cast flanged fittings: ANSI/ASME-B16.24, Class 150.
6. 400 PSI fittings: Heavy wall type, Mueller "Steamline".

E. Cast Iron Pressure Pipe Fittings:
1. ANSI/ASME B16.1 and ANSI/AWWA C111/A21.11 mechanical joint type, suitable for minimum working pressure of 150 PSI plus 100 PSI surge pressures.
2. Laying length:
a. AWWA fittings: Short body dimensions.
b. ANSI mechanical joint fittings: ANSI/AWWA-C110/A21.10.
c. Others: ANSI/ASME-B16.1.
3. Thickness, 6 through 12 IN: Not less than for cast iron pipe with additional thickness as required for proper reinforcement of branches for tees and crosses.

F. Dielectric Fittings:

1. General:
   a. Standard product for prevention of galvanic corrosion.
2. Dielectric union:
   a. Ground-joint union with end connections of different material.
      1) End connection materials: Compatible with respective piping materials.
      2) Gasket and inert, non-corrosive thermoplastic sleeve shall electrically isolate end connections from each other.
3. Dielectric waterway fitting:
   a. ASTM A53 Schedule-40, hot dip galvanized, steel pipe casing with inert, non-corrosive thermoplastic lining (NSF/FDA listed).
   b. Threaded or threaded X rolled grooved connections.
   c. Victaulic, "Clearflow".

G. Mechanical Groove-end Couplings and Fittings:
1. Couplings:
   a. Malleable iron, ASTM A47 or ductile iron, ASTM A536.
   b. Gaskets: EPDM Grade-E conforming to ASTM D2000 for water services up to 230 degF.
   c. Gaskets on plastic piping: ASTM F477.
   d. Bolts and nuts: ASTM A183.
      1) Heat treated plated carbon steel, track-head.
      2) Minimum tensile strength: 110,000 PSI.
2. Fittings:
   a. Malleable iron, ASTM-A47 or ductile iron, ASTM-A536.
   b. Copper:
      1) 2 IN to 4 IN: ASTM-B75, C12200.
      2) 5 IN to 6 IN: ASTM-B584, CDA 844 (81-3-7-9).

H. Unions.
1. Same type, pressure rating and material as piping.
2. Flanges: Raised face type of same type, pressure rating and material as piping.
3. Unions in copper pipe:
   a. 2 IN and smaller: Use wrought copper solder joint copper to copper unions.
   b. 2-1/2 IN and larger: Use brass flange unions.
4. Dielectric unions: See Dielectric fittings:

PART 3 - EXECUTION

3.1 GENERAL

A. Comply with ANSI/ASME B31.9 for pressure piping installations.
1. Install piping without "bull-head" fittings.

B. Flush out water piping systems with clean water prior to adding treatment.

C. In general, make connections to components in piping systems with 3-elbow swing joints to allow for movement.
1. Movement includes but not limited to expansion, contraction, seismic, and equipment vibration isolation.

3.2 PIPING

A. Install piping parallel to building walls at such heights as not to obstruct portion of window, doorway, stairway, or passageway.
1. Where interference develops in field, offset or reroute piping as required to clear such interferences.

2. Consult Drawings for exact location of pipe spaces, ceiling heights, door and window openings or other architectural details and report discrepancies to Architect, before installing piping.

B. Pitch Piping to Drain:
1. Minimum pitch of 1 IN in 100 FT(except drainage piping).
2. Make piping and equipment drainable.
3. Accomplish pipe drainage using drain valves located on equipment and fixtures or separate drains.
4. Drains: See Section 20 05 19.

C. Factory cut and thread nipples from seamless stock.
1. Use nipples of same material as pipe with which they are used.
2. Do not use close nipples except where such use is unavoidable.
3. Use Schedule-80 seamless pipe for close nipples and nipples of pipes 3/8 IN or smaller.

D. Provide backing and sleeves required in walls or floors for setting of fixtures or equipment.

E. Where transition occurs from sweated fittings (as at connection to fixture supplies, etc.), provide rigid anchorage so that no strain will be placed upon tubing.

3.3 JOINTS

A. Threaded Joints:
1. Cut piping carefully, ream, thread and work into place without springing.
2. Use a small amount of prepared pipe thread lubricant on outside threads only.
3. Provide in accordance with ANSI/ASME-B1.20.1.

B. Flanged Joints:
1. Take care to ensure that there is no restraint on opposite end of pipe or fittings which would prevent uniform gasket compression or cause unnecessary stress in flanges.
2. Keep one flange free to move in any direction while flange bolts are being tightened.
3. Do not pack or assemble bell and spigot joints affected by flanged joints until such flanged joints have been tightened.
4. Tighten bolts gradually and at a uniform rate, so that gasket compression is uniform over entire area of gasket.

C. Mechanical Joints:
1. Assemble in accordance with instructions and recommendations of pipe manufacturer.
2. Clean joint surfaces and lubricate with soap solution or water soluble lubricant immediately before joint is assembled.
3. Groove-end and plain-end joints:
   a. Use mechanical joint system only with pipe meeting joint manufacturer's requirements.
      1) When joint manufacturer's pipe requirements exceed specified requirements, provide pipe that meets joint manufacturer's requirements.
   b. Prepare pipe and install system in accordance with joint manufacturer's instructions and recommendations.

D. Use dielectric waterway fittings for connections between dissimilar metals.

3.4 UNIONS

A. Provide a union between valves, at connection to each fixture, device or item of equipment, and elsewhere as required to facilitate installing, servicing, making up and disconnecting piping.
1. Install each union to facilitate removal of parts, equipment or fixtures for inspection or cleaning.
2. Install in a position which will permit device, fixture or part to be removed without disconnecting piping except unions.

B. Install unions in accordance with Fluid Controls Institute (FCI).
1. Grooved piping systems:

a. Grooved type couplings may serve as unions.
2. Make connections between couplings and flanged equipment with slip-on flanges and a grooved nipple, or groove-to-flange adapter.
3. Welded piping systems:
a. Where flanged end-service valves are used at equipment connections, flange unions will not be required.
b. Make connections to flanged valves and equipment using ANSI welding neck or slip on type welding flanges.
c. Flanged cast iron ells may be used for connections between pumps, strainers, check valves and other flanged equipment.

C. Install dielectric fitting at each piping joint and equipment connection between ferrous and non-ferrous materials.

3.5 PIPING EXPANSION

A. Install piping to allow thermal expansion and contraction without injury to piping, equipment or structure.
1. Use loops or expansion joints where necessary and where detailed.
2. Provide pipe guides at loops as indicated.

B. Where screwed piping is used for soil, waste or vent risers, or downspouts, use caulked joints or expansion joints at intervals to allow expansion movement.

3.6 WELDED STEEL PIPING

A. Where welded piping is specified, make welds by oxy-acetylene or electric process in accordance with ANSI/AWS D10.12 and ANSI/AWWA C206.
1. Welding rods: Grade recommended for purpose by manufacturer; each rod stamped with manufacturer's name and identification.

B. Line Welds:
1. Single V-butt type.
2. Mill or machine bevel pipe at 37.5 degrees to within 1/16 IN of inside wall, except that in field, limited amount of pipe may be flame beveled.
3. Pipe with a wall thickness of 3/16 IN or less need not be beveled but may be welded by melting down into, and building up over abutting ends.
4. Separate abutting ends of joints before welding to permit complete fusion to bottom without overlapping.
5. Tack in 2 or more points to maintain alignment, and fusion weld.
6. Weld continuously around pipe.

C. Make welds of sound weld metal, thoroughly fused into ends of pipe, and to bottom of vee.
1. Build in excess of pipe wall to give reinforcement of 0.25 pipe wall thickness.
2. Weld metal shall present a gradual increase in thickness from surface of pipe to center of weld.
3. Minimum weld width: 2.5 times thickness of pipe wall.

D. Use welding ells at turns in welded lines except where pipe bends are indicated or are required for flexibility.

E. Mitered ells will not be permitted.

F. Do not weld pipe couplings in place of welding fittings for branch connections.

G. Weld-O-Lets and Thread-O-Lets:
1. Scribe and cut openings in main pipes for welded branches accurately taking care to remove plug and cuttings from main pipe.
2. Full weld fillet welds for full depth of fillet, with additional beads to form well rounded connection as recommended by Weld-O-Let manufacturer.
a. Partially filled fillets not acceptable.

H. Cut openings into pipe for welded connections accurately to give carefully matched intersections.

I. Make welded fittings of same material with same pressure and temperature rating as pipe with which they are used.

J. Make flanged connections to control valves, pump suction, and specialties with ANSI standard welding neck flanges.
   1. Other flange connections may be made with slip-on flanges provided they are seal welded on inside.

K. Fuse fillet welds for flanges or fittings into pipe and plate for minimum distance of 1.5 times pipe wall thickness and depth of weld of 1.25 times pipe wall thickness.

3.7 THREADED STEEL PIPING

A. Branch connections to screwed piping may be made with Weld-O-Lets or Thread-O-Lets.

B. Do not weld pipe couplings in place of welding fittings for branch connections.

3.8 DUCTILE IRON AND CAST IRON PRESSURE PIPING

A. Perform cutting without damage to pipe or to cement lining.
   1. Make pipe cuts smooth, straight and at right angles to pipe axis.
   2. Use approved type mechanical pipe cutters.
   3. In locations where use of mechanical cutters would be difficult or impracticable, existing pipe may be cut with diamond point chisels, saws, or other tools which will not cause damaging impact or shock.

B. Use equipment, tools and methods in handling and laying pipe and fittings which prevent damage.
   1. Hooks inserted in ends of pipe shall have broad, well padded contact surfaces.

C. Replace pipe and fittings in which cement lining has been broken or loosened.
   1. Where damaged areas are small and readily accessible, lining may be repaired, if Architect approved.

D. Repair pipe coating which has been damaged before installing pipe.

E. Make connections between below ground piping and above ground piping with a flanged spigot adapter.
   1. Hold spigot piece in place with bolts on 2 sides of flanges between mechanical joint and flange connector.

F. Comply with AWWA C600 for installation.

3.9 CAST IRON DRAINAGE PIPING

A. Lay underground pipe on undisturbed earth excavated to provide firm bearing on at least 0.333 of pipe circumference for full length, with bell holes cut out.
   1. Where excavation has been carried too deep, place a layer of sand well tamped to bring pipe to proper grade.
   2. Where fill or unsound earth is encountered, place a layer of 2500 PSI concrete to properly bed pipe.

B. Bell and Spigot Joints:
   1. Install neoprene gaskets in accordance with manufacturer's recommendations.
   2. Caulk tarred oakum well into joint and pour in molten lead continuously around joint, using at least 12 OZ of lead per IN of pipe diameter.
   3. Furnish sufficient lubricant to provide a thin coat on each spigot end.

4. Use lubricant that is non-toxic, imparts no taste or odor to conveyed liquid, and has no deleterious effect on rubber gasket, with consistency so that it can be easily applied to pipe in hot or cold weather and will adhere to either wet or dry pipe.

C. Threaded Joints:
1. Clean cut, American National taper pipe threads.
2. Ream pipe ends to full pipe size and remove burrs, chips, cuttings before making up.
3. Pipe joint cement permitted on male threads only.

3.10 COPPER PIPING

A. Brazed High Temperature Soldered Joints:
1. Take care to avoid annealing of pipe material.
2. For pipe sizes 2 IN and larger: Use a circular torch such as Circa Torch by Cedarberg Industries, for soldering joints.

B. Solder: Lead-free.

C. T-drilling:
1. Tapped pipe shall be least 1 IN diameter and branch shall be at least 2 pipe sizes smaller.
2. Braze high temperature solder joints.
3. Branch pipe shall not protrude into main.

END OF SECTION

DIVISION 21

FIRE SUPPRESSION

SECTION 21 10 00
FIRE PROTECTION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Fire Protection Systems, as indicated, in accordance with provisions of Contract Documents.

B. Fire Protection Systems Included:
   1. Water based:
      a. Standpipe-and-hose system.
      b. Wet-pipe sprinkler system.
   2. Products:
      a. Pipe, fittings, and supports.
      b. Alarm and signal devices.
      c. Fire hose cabinets.
      d. Fire system valves.
      e. Manual valves.
      f. System accessories.
      g. Sprinklers.
      h. Flexible sprinkler hose fittings.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Use only new material of first class construction, designed and guaranteed to perform service required.

B. Provide fully operational systems.

C. Provide complete fire protection systems as described in the Contract Documents and according to criteria of authority having jurisdiction (AHJ) and the Owner's insurance carrier.
   1. Where system requirements as described in the Contract Documents exceed those of the AHJ, meet requirements of both.
   2. Where discrepancies exist among the AHJ, Owner's insurance carrier, and Contract Documents, the most stringent requirements shall take precedence.

D. Addition, deletion, or relocation of existing sprinklers, and rerouting of existing pipe may be necessary.

E. Do not downsize piping indicated to serve future areas.

F. Authorities Having Jurisdiction:
   1. Code Enforcement Agencies.
   2. Fire Marshall's Office.
   3. State Insurance Office.
   4. Water Supply Authority.

G. Owners Insurance Carrier: Travelers Insurance.

H. Referenced Criteria (applicable as referenced by AHJ and Owner's insurance carrier):
   1. Latest edition of referenced criteria applies unless an earlier edition is specifically indicated by the AHJ and Owner's insurance carrier.
   2. National Fire Protection Association (NFPA).
   3. Underwriter's Laboratories (UL).

4. Factory Mutual Engineering Commission (FM).

I. Installer Qualifications:
1. Fire Protection Installer shall be licensed, and shall provide evidence of the successful completion of at least five projects of equal or greater size and complexity.
2. Use workmen skilled in this trade.
3. Provide documentation that welders, and welding operators are certified in accordance with American Welding Society Standard AWS D10.9.
4. Installation of the following items/systems shall be done by authorized representatives of respective manufacturers:
   a. Fire system valves.

J. Piping and Fittings: Section 20 11 00.

1.3 SUBMITTALS

A. Product Data:
1. Standpipe-and-hose system.
2. Wet-pipe sprinkler system.

B. Project Information:
1. Submit detailed data and complete layout of fire protection systems approved by authorities having jurisdiction (including Owner's insurance carrier) and prepared in accordance with the requirements for Working Plans described in applicable NFPA standards.
   a. Include calculations prepared in accordance with the requirements for Hydraulic Calculations described in applicable NFPA standards.
2. Architect reviews for project information and general conformance with contract documents.

C. Contract Closeout Information:
1. Letter, with Owner acceptance signature, stating spare parts and extra materials per NFPA requirements have been delivered.
2. Operating and maintenance data.
3. Owner instruction report.
4. Test reports:
   a. Factory pump tests as indicated in this section's Part I "Quality Assurance" paragraph.
   b. Certification that tests as indicated in FIELD QUALITY CONTROL (Part 3) have been successfully completed and approved by authorities having jurisdiction.

1.4 JOB CONDITIONS

A. Arrange and pay for permits, fees and inspections required.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Alarm and Signal Devices:
1. Base:
   a. Viking.
2. Optional:
   a. Federal Signal.
   b. Fire-Lite Alarms/Notifier.
   c. Potter Electric Signal.
   d. Potter Roemer.
   e. Simplex Access Controls.
   f. United Electric Controls.

B. Alarm-test Device:
   1. Base:
      a. Viking.
   2. Optional:
      a. Grinnell.
      b. Victaulic of America.
      c. AGF Manufacturing Inc.

C. Fire Department Connections, Fire Department Valves, Fire Hose Cabinets, and Hydrants:
   1. Base:
      a. Elkhart Brass.
   2. Optional:
      a. Croker West.
      b. Grinnell.
      c. JL Industries.
      d. Larsen's Manufacturing.
      e. Potter Roemer.
      f. Seco.
      g. Waterous.

D. Fire Protection Systems, Water Based:
   1. Base:
      a. Viking.
   2. Optional:
      a. Central Sprinkler.
      b. Firematic Sprinkler Devices.
      c. Globe Fire Sprinkler.
      d. Potter Roemer.
      e. Star Sprinkler.

E. Sprinklers:
   1. Base:
      a. Viking.
   2. Optional:
      a. Firematic Sprinkler Devices.
      b. Globe Fire Sprinkler.
      c. Reliable Automatic Sprinkler.
      d. Star Sprinkler.

F. Flexible Sprinkler Hose Fittings
   1. Base:
      a. Victaulic, AquaFlex
   2. Optional:
   3. Flexhead Industries, Inc.

G. Submit other pipe materials, joining methods, and equipment not specified, but accepted by applicable NFPA standards and approved by Authority Having Jurisdiction, in accordance with Section 00 26 00.

2.2 DESIGN REQUIREMENTS

A. Design fire sprinkler and suppression systems.
   1. Obtain water supply fire flow test prior to designing systems.
   2. Design systems using adjusted water supply curve:
      a. Adjust the flow test water supply curve to correspond with the low hydraulic grade line as provided by the water supplier.
   3. Designs shall include a minimum safety allowance of 10 PSIG below the adjusted water supply curve.

4. For systems with fire pumps, demonstrate (through calculations) that adjusted water supply is capable of providing a minimum of 20 PSIG at the suction side of the fire pump while the pump is operating at 150 percent of its rated capacity.

2.3 PIPE, FITTINGS, AND SUPPORTS

A. Pipe and Fittings - General:
   1. Meet or exceed applicable NFPA standards and Section 20 11 00.
   2. Working pressure: Not less than 175 PSI.
   3. The following are not permitted:
      a. Lightwall and Schedule 5 pipe.
      b. Plain end, pressure fit type fittings.
      c. Hole cut mechanical tee fittings.
   4. Fittings: galvanized where galvanized piping is used.
   5. Corrosion Resistance Ratio (CRR) of all pipe used: equal to or greater than one.

B. Above ground pipe normally containing water:
   1. Examples: Wet-pipe and standpipe-and-hose fire protection systems.
   2. Sprinkler piping 4 IN and greater:
      a. Black steel, Schedule-10:
         1) Welded joints.
         2) Mechanical coupling joints:
            a) Rolled groove type (cut grooving not allowed).
            b) Mechanical locking (push-on) type.
   3. Sprinkler piping less than 4 IN:
      a. Black steel, Schedule-40:
         1) Threaded joints.
         2) Welded joints.
         3) Mechanical joints:
            a) Cut or rolled groove type.
            b) Mechanical locking (push-on) type.
   4. Seamless copper tubing.
      a. High temperature soldered joints.

C. Fittings:
   1. Threaded:
      a. Black cast iron, Class 150.
      b. Black malleable iron.
      c. Galvanized malleable iron.
   2. Flanged:
      a. Black cast iron, short body, Class 125.
      b. Galvanized malleable iron.
      c. Gaskets: Full face of 1/8 IN minimum red sheet rubber.
      d. Flange bolts: ANSI-B18.2.
         1) Hexagon head machine bolts with heavy semi-finished hexagon head nuts, cadmium plated.
   3. Welded:
      a. Black steel, standard weights.
   4. Mechanical: ASTM-A47.
      a. Malleable iron, 500 PSI working pressure.
      b. Coupling gasket material: Butyl rubber.
      c. UL listed.
      d. Approved by FM, NFPA-13, and NFPA-14.
   5. High temperature soldered:
      a. Wrought copper.
      b. Cast bronze.

D. Pipe Supports:
   1. All-purpose type, UL listed and FM approved.
   2. Manufacture: Comply with Section 20 05 29.
   3. Supports, hanger rods, inserts and clamps acceptable to NFPA.

2.4 ALARM AND SIGNAL DEVICES

A. UL listed and FM approved.

B. Coordinate electrical requirements with electrical installer.

C. Alarm Devices:
   1. Alarm pressure switch:
      a. Shall signal Fire Alarm System Control Panel upon sensing change of pressure in fire system valve.
         1) Switch shall automatically reset when pressure returns to normal.
      b. Service: Normal.
   2. Local alarm devices:
      a. General:
         1) Provide local alarm on systems of sufficient size as indicated in NFPA-13.
         2) Use alarm bell and visible light alarm on electrically operated supplemental fire detection (valve release) systems.
         3) Use water motor gong on hydraulically or pneumatically operated supplemental fire detection (valve release) systems.
         4) Devices shall be weatherproof.

D. Signal Devices:
   1. Valve tamper switch:
      a. Shall signal Fire Alarm System Control Panel upon valve movement.
   2. Waterflow detector:
      a. Shall signal Fire Alarm System Control Panel when water flows in system.
      b. Vane type flow switch with retard mechanism or manual adjustment to prevent false alarm.
      c. 175 PSI rated.
      d. Suitable for working pressure of 150 PSI with sensitivity adjusting screw.
   3. Pressure supervising switch:
      a. Shall signal Fire Alarm System Control Panel upon drop in air pressure.
         1) Adjustable low-pressure setting.

2.5 FIRE PROTECTION SYSTEMS, WATER-BASED

A. Supplemental Fire Detection Valve Release System:
   1. Detection system shall be part of UL listed and FM approved fire protection system.
   2. Provide hydraulically, pneumatically, or electrically actuated supplemental fire detection system as indicated in system description.
      a. Hydraulically actuated system:
         1) Do not use where system may be subject to freezing.
      b. Electrically actuated system:
         1) May be used with any fire protection system.
   3. Support supplemental detection system piping/wiring separately from sprinkler piping.
   4. Devices for hydraulically or pneumatically actuated supplemental detection systems:
      a. Sprinkler with temperature setting lower than normal system sprinklers.
      b. Thermostatic device that causes fire valve to operate when space temperature rises faster than 15 degF per minute.
      c. Combination of sprinkler and thermostatic devices.

B. Standpipe-and-Hose Fire Protection System:
   1. Class I:
      a. Standpipes, fire department connections, and fire department valves.

C. Wet Pipe Fire Protection Sprinkler System:
   1. Description: Automatic system shall employ closed sprinklers attached to a piping system filled with pressurized water.
      a. Normal operation:
         1) Actuation of sprinkler allows water to flow through actuated sprinkler.
         2) Waterflow in zone sends signal to Fire Alarm System Control Panel.
      b. Failure of sprinkler allows water to flow through sprinkler.
         1) Waterflow in zone sends signal to Fire Alarm System Control Panel.

2.6 FIRE DEPARTMENT VALVES AND FIRE HOSE CABINETS

A. Components and assemblies UL listed and FM approved.

B. Outlet threads shall match local fire department standards.

C. Valves:
   1. Minimum 175 PSI non-shock cold-water working pressure.

D. Cabinet:
   1. For use with fire department valves and fire hoses.
   2. Standard Cabinet: Recessed-cabinet mounting box: 18 or 20 GA steel with baked white enamel inside.
   3. Door frame:
      a. For use with recessed and semi-recessed cabinets.
      b. 16 or 18 GA steel.
   4. Door:
      a. Standard door: Continuously hinged 20 GA steel.

E. Fire Department Valves:
   1. General:
      a. 2-1/2 x 2-1/2 IN valve.
      b. Cap and chain.
      c. Pattern: Straight or angle.
   2. FDV, Fire department valve without cabinet:
      a. Finish: Polished brass.
   3. FVC-1, Fire department valve with cabinet:
      a. Cabinet mounting:
         1) Recessed.
      b. Door style:
         1) Solid with lever handle cam latch.
      c. Cabinet and door finish:
         1) Prime painted.
      d. Valve finish:
         1) Rough brass.
      e. Mark: "FIRE DEPARTMENT VALVE".
      f. Cabinet to be certified and listed for a 2-hour combustible wall system.
      g. Example: Guardian FR2020.

2.7 FIRE SYSTEM VALVES

A. UL listed and FM approved.

B. Body: Ductile or cast iron.

C. Pressure rating: 175 PSI non-shock cold-water working pressure.

D. 2 IN and smaller: Threaded.

E. 2-1/2 IN and larger: Flanged or grooved.

F. Trim to meet NFPA requirements.

G. Trim to meet performance as indicated in descriptions of fire protection systems.

2.8 MANUAL VALVES

A. Isolation Valves:
   1. Butterfly valves:
      a. 2 IN and smaller: V-55.
      b. 2-1/2 IN and larger: V-51.
   2. Butterfly valves with tamper switches:
      a. 2-1/2 IN and smaller: V-59.
      b. 3 IN and larger: V-61.

B. Check Valves 2-1/2 IN and larger: V-53 or V-54.

C. Automatic Ball Drip Valve:
   1. 1/2 IN straight or angle cast-brass ball drip shall close against pressure.
      a. When pressure drops, valve shall open to drain pipe.

2.9 SPRINKLERS

A. UL listed sprinklers of style and type required for service indicated.

B. Sprinklers in systems sized from pipe schedules shall have 1/2 IN nominal orifices.

C. Finish of exposed parts: As indicated.

D. Sprinkler types: Metallic fusible link or glass bulb.

E. Sprinkler Styles:
   1. Upright:
      a. Finish: Standard bronze.
   2. Pendant:
      a. Finish: Standard bronze.
   3. Pendant with escutcheon:
      a. Finish: Chrome.
   4. Recessed pendant:
      a. Deflector: 1 to 1-1/2 IN below finished ceiling.
      b. Escutcheon: Two-piece with 1/2 IN adjustment.
      c. Removal of escutcheon and ceiling tile shall not disturb sprinkler or drop assembly.
      d. Finish: Chrome.
   5. Flush pendant:
      a. Escutcheon: 1/2 IN adjustment.
      b. Finish: Chrome.
   6. Tamper-proof flush pendant:
      a. Escutcheon: 1/2 IN adjustment.
      b. Specifically designed to prevent occupant from using sprinkler to injure themselves or others.
      c. Finish: Chrome.
   7. Concealed pendant:
      a. Ceiling plate flush with finished ceiling.
      b. Housing: 1/2 IN adjustment.
      c. Finish: Paintable surface to match ceiling color or White. Coordinate with Architectural Plans.
   8. Horizontal sidewall:
      a. Finish: Chrome.

9. Horizontal sidewall, extended coverage:
    a. Finish: Chrome.

2.10 FLEXIBLE SPRINKLER HOSE FITTINGS:

A. Hose fittings – general
    1. Hose fitting shall be stainless steel for use in connecting sprinkler heads in commercial suspended ceilings. A bracket attaches to the ceiling grid for supporting the hose.

B. Hose fittings shall be braided stainless steel, hose fittings and accessories shall be FM 1637 approved.

2.11 SYSTEM ACCESSORIES

A. Alarm Test Device:
    1. Optional replacement for alarm test loop.
    2. Single device or unit that provides visual verification of waterflow in a fire sprinkler system and allows for draining of all or a portion of that system.
    3. Contains sight glass, inspector test valve, auxiliary drain valve and test orifice.
    4. UL listed and FM approved.

B. Pressure Gauges:
    1. UL listed and FM approved.
    2. See Section 20 05 19.

C. Spare Parts:
    1. Tools:
        a. Furnish one emergency rubber ball shutoff on long handle to be used for temporary closing of sprinkler after fire has been extinguished.
        b. Furnish testing apparatus capable of producing the heat or impulse necessary to operate supplemental fire detection systems in manner recommended by manufacturer of detection system.
    2. Sprinkler cabinet, Wall mounted:
        a. Provide spare sprinklers of each type and sprinkler wrench for each type in quantities required by NFPA-13.

D. Sprinkler Guards:
    1. UL listed.
    2. Heavy duty welded wire.
    3. Red baked enamel finish.

PART 3 - EXECUTION

3.1 GENERAL

A. Coordinate with other trades to ensure adequate space for equipment and piping placement.

B. Review plans, specifications and shop drawings of other trades to coordinate work.

C. Do not begin installation until after Agency approvals have been submitted to Architect.

D. Test systems in accordance with System Standards, manufacturers' instructions, and applicable NFPA publications.

E. Install systems in accordance with System Description, manufacturers' instructions, and approved shop drawings.
    1. Modifications to system design or arrangement after approval of drawings may only be made after receiving written approval of Architect and authority(ies) having jurisdiction.
    2. Such modifications do not include minor relocations in piping or sprinkler placement.
    3. Make revisions in accordance with NFPA.

F. Maintain fire and smoke ratings where mechanical items penetrate fire and fire/smoke rated building elements.

G. Field quality control: Give advance notice and arrange for field tests and inspections by authority(ies) having jurisdiction.

3.2 PIPING, SPRINKLERS, AND SUPPORTS

A. Piping - General:
   1. Install sprinkler piping within first 6 IN of space under floor construction.
      a. Where conditions of construction require piping installation at a lower elevation, route piping to avoid interference with work of other trades.
   2. Avoid interconnecting standpipes through sprinkler system piping.
   3. Offset, crossover and otherwise route piping to install system in available space.
      a. Not every offset is indicated.
   4. Install chromed escutcheons on finished-area sides of pipe penetrations.
      a. Secure escutcheons so they make contact with floor, wall, or ceiling.
   5. When risers are concealed, provide wall flange at each FDV and within cabinets.
   6. Pitch branch lines, cross mains, feed mains and risers to drains.
   7. Paint fire sprinkler piping in accordance with Section 09 91 23.
   8. Flush outside fire-main piping prior to connecting to inside system.
   9. Remove and relocate all sprinkler piping interfering with the routing of all new ductwork on the 4th floor, 1st floor, and basement. Coordinate with mechanical contractor for extents of piping to be relocated.

B. Sprinklers - General:
   1. Install sprinklers to provide and maintain minimum 18 IN clear between bottom of deflector and top of storage, files, shelving, and cabinets.
   2. Standard-application temperature rating:
      a. Sprinkler type:
         1) Glass bulb: 155 degF.
         2) Fusible link: 165 degF.
      b. Where non-standard applications exist, use higher rating.
         1) Use sprinklers rated at least 50 degF higher than anticipated ambient temperature.

C. Supports:
   1. Install in accordance with NFPA-13 and NFPA-14.

D. Testing - General:
   1. Test sprinkler and standpipe piping, including outside supplies, under hydrostatic pressure of 200 PSI for 2 hours.
      a. Prove system tight to satisfaction of Architect.
      b. Inside piping shall indicate no leakage.
      c. Leakage in underground piping shall be in accordance with NFPA-24.

E. Piping and Sprinkler - Application by room type:
   1. Cells, holding tanks, sallyports, all spaces with security ceiling (see architectural plans):
      a. Do not run exposed sprinkler piping.
      b. Sprinkler style: Tamper-proof flush pendant.
   2. Electrical rooms/closets:
      a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
      b. Provide sprinkler guards.
   3. Finished rooms (rooms with ceilings):
      a. Sprinkler styles:
         1) Concealed pendant.
         2) Horizontal sidewall, standard or extended coverage.
      b. Where ceiling is being replaced in existing areas, relocate existing sprinklers to coordinate with new ceiling layout.

c. Locate sprinklers to coordinate with ceiling layout.
   1) Locate sprinklers centered in ceiling tile and in center of metal strip in linear metal ceilings, if such location makes added sprinklers necessary, provide added sprinklers as required to meet code.

4. Mechanical equipment rooms:
   a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
      1) Glass bulb temperature rating: 200 degF.
      2) Fusible link temperature rating: 220 degF.
   b. Provide sprinkler guards.
5. Secure holding rooms:
   a. Do not run exposed piping.
   b. Sprinkler style: Tamper-proof flush pendant.
6. Telephone/Communication rooms/closets:
   a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).
   b. Provide sprinkler guards.
7. Unfinished rooms (rooms without ceilings):
   a. Sprinkler styles: Upright, pendant, or horizontal sidewall (standard or extended coverage).

3.3 ALARM AND SIGNAL DEVICES

A. Where multi-zone, wet-pipe fire protection sprinkler systems exist, provide waterflow detector at each zone take off immediately after isolation valve.

B. Install valve tamper switch on each isolation valve indicated below:
   1. Valves at bases of standpipes.
   2. Valves at fire system valves.
   3. Valves in fire pump suction piping including valves across water meters and backflow protection devices.
   4. Valve at fire pump discharge.
   5. Sprinkler-zone valves.
   6. Post indicator valves.

3.4 FIRE PROTECTION SYSTEMS

A. Factory trained Engineer shall supervise installation of fire protection systems.

B. On combination sprinkler and standpipe-and-hose systems, do not interconnect standpipes through sprinkler piping.

C. Factory trained Engineer shall provide following services:
   1. Supervise installation of fire protection systems.
   2. Instruct Owner's personnel in systems operations.

D. Test completed alarm systems including control and signal circuits wired by Electrical installer.
   1. Coordinate with electrical.
   2. Complete testing prior to substantial completion.

3.5 FIRE DEPARTMENT CONNECTIONS, FIRE DEPARTMENT VALVES, AND FIRE HOSE CABINETS

A. Install fire department connections, fire department valves, and fire hose cabinets at height required by authority having jurisdiction.
   1. Position valve to allow 12 IN spanner wrench clearance for connecting hoses.

3.6 MANUAL VALVES

A. Provide isolation valves at following locations:

1. Bases of standpipes.
2. Fire system valves.
3. Suction and discharge of fire pump.
   a. Suction isolation valve must be OS&Y type.
   b. Discharge isolation valve must be indicating type.
4. Flow test system:
   a. Inlet to hose valve manifold.
   b. Inlet and outlet of flow meter.
5. On combination sprinkler and standpipe-and-hose systems, provide isolation valve at each sprinkler-zone take off from standpipes.

B. Provide check valves at following locations:
   1. Outlet of fire pump: In-line, spring-actuated check.
   2. Fire department connection.

C. Install indicator posts approximately 3 FT above grade.

D. Provide automatic ball drip at low points.
   1. Piping between outside fire department connection and check valve.
   2. Piping between outside fire department connection and pump test header shutoff valve.

3.7 SYSTEM ACCESSORIES

A. Alarm Test Loops:
   1. Provide after each waterflow detector.
   2. Alarm test loop consists of two parallel branches.
      a. First branch: Inspector's test branch shall contain a shutoff valve and a restricting orifice imitating the flow through the smallest sprinkler on the system. Provide means for inspector to observe water flow (e.g., drain water within sight of valve or provide sight glass).
      b. Second branch: Drain branch shall contain shutoff valve.
      c. Alarm test loop sizing criteria:
         1) Riser or Main is 2 IN or smaller: 3/4 to 2 IN.
         2) Riser or main is 2-1/2 to 3-1/2 IN: 1-1/4 to 2 IN.
         3) Riser or main is 4 IN or larger: 2 IN.
   3. Extend loops to nearest floor drain or mop sink.
      a. Loops may be terminated outside when approved by authority having jurisdiction.
   4. Label valves and outlets.

B. Drains:
   1. Permit complete draining of systems without disconnection of piping.
   2. Drain consists of dirt leg, valve, and piping.
   3. Extend drain piping to nearest floor drain or mop sink.
   4. Required locations:
      a. At low points of systems.
      b. At fire pump.
      c. At alarm test loops.
      d. At fire system valves.
      e. At bases of risers and standpipes.
         1) 1-1/2 IN hose threads that match local fire department threads may be provided instead of extending piping.
   5. Size drain valve and piping according to alarm test loop sizing criteria in this section.
   6. At offsets, plugs may be substituted for drains when approved by authority having jurisdiction.

C. Pressure Gauges:
   1. Provide at following locations:
      a. On each discharge pipe from fire pump.
      b. At service entrance to building.

c. At top of each standpipe.
d. At inlet and outlet of pressure reducing valves.
e. At top of each sprinkler riser.
f. At alarm test loops.
g. At other indicated locations.

2. Provide shutoff valve and drain for each gauge.

3.8 ELECTRICAL WIRING

A. Provide Following:
1. Wiring diagrams for devices.
2. Supplemental fire detection systems and their wiring.
3. Wiring not specified but required to provide an operating system.

B. Electrical Installer shall provide following:
1. Alarm and signal device wiring:
a. Tamper switches: Supervised wiring to Fire Alarm System Control Panel.

END OF SECTION

DIVISION 22

PLUMBING

SECTION 22 10 16
PLUMBING PIPING

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Plumbing Piping, as indicated, in accordance with provisions of Contract Documents.

B. Systems and Products Included:
   1. Systems:
      a. Cold, hot, and circulating domestic water piping systems within building and to 5 FT outside building wall.
      b. Drainage piping systems:
         1) Soil, waste, vent, indirect, and storm piping within building and to 5 FT outside building wall.
   2. Products:
      a. Backflow protection devices.
      b. Cleanouts.
      c. Drains:
         1) Air gap fittings.
         2) Floor drains.
         3) Floor sinks.
      d. Drip pans over critical areas.
      e. Traps.
      f. Valves:
         1) Balancing valves, constant flow control.
         2) Check valves.
         3) Manual valves, potable water.
         4) Pressure reducing valves.
      g. Water hammer arresters.

C. Definitions:
   1. Caulked: Tamped lead and oakum joint.
   2. Drainage piping: Soil, waste, vent, acid waste, acid vent, indirect, and storm piping.
   3. Brazing: High temperature soldering.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Outside Utilities: See Section 20 10 10.

B. Pipe and fittings standards: See Section 20 11 00.

C. Fire Protection Systems: See Section 21 10 00.

D. Valve standards: See Section 20 05 23 (for valves labeled "V-__").

E. American Water Works Association Standard AWWA C601: Sterilization Standard.

F. Plumbing and Drainage Institute Standard WH201: Water hammer arrester standard.

G. Plumbing and Drainage Institute Standard G10: Grease interceptor standard..

H. American Society for Sanitary Engineering Standard ASSE 1001: Pipe Applied Atmospheric Type Vacuum Breakers.

I. American Society for Sanitary Engineering Standard ASSE 1013: Reduced Pressure Principle Backflow Preventers and Reduced Pressure Fire Protection Principle Backflow Preventers.

J. Standard: American Society for Sanitary Engineering Standard ASSE 1020: Pressure Vacuum Breaker Assembly.

K. Comply with NSF 61 for potable domestic water piping and components that come in contact with potable water.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Piping layout drawings at 1/4 IN/FT scale.

B. Product Data:
   1. Include sufficient information to verify compliance with specifications:
      a. Backflow protection devices.
      b. Drains.
      c. Valves.
      d. Water hammer arresters.

C. Contract Closeout Information:
   1. Pressure test reports.
   2. Disinfection test report.
   3. Operating and maintenance data.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Reduced Pressure Principle Backflow Protection Device:
   1. Base:
      a. Cla-Val.
   2. Optional:
      a. Watts Regulator.
      b. Febco.
      c. Hersey Measurement.
      d. Wilkins Regulator.

B. Cleanouts and Drains:
   1. Base:
      a. Wade Division/Tyler Pipe.
   2. Optional:
      a. Watts Drainage - Ancon.
      b. Josam Company.
      c. JONESPEC Plumbing Products.
      d. Jay R. Smith Manufacturing Co.
      e. Zurn Industries, Inc.

C. Constant Flow Control Balancing Valves:
   1. Base:
      a. Red White Valve Corp.
   2. Optional:
      a. Griswold Controls COMBO
      b. Flow Design Inc. - Autoflow.
      c. Preso.

D. Pressure Reducing Valves:
   1. Base:

a. Cla-Val.
2. Optional:
a. Watts Regulator.
b. Fisher.
c. Wilkins Regulator.

E. Water Hammer Arresters:
1. Base:
a. Wade Division/Tyler Pipe.
2. Optional:
a. Jay R. Smith Manufacturing Co.
b. Josam Company.
c. Zurn Industries, Inc.

2.2 PIPE AND FITTINGS

A. Domestic Water Piping:
1. Domestic water piping at service entrance from 1 FT inside building to 5 FT outside: Same as indicated for outside utilities.
2. 2 IN and smaller after service entrance:
a. Above grade:
1) Copper, type L, with solder joints, and wrought copper or cast brass fittings.
2) Optional fitting:
a) Ring Seal Crimp fitting system: With approval of local authority having jurisdiction.
3. 2-1/2 IN and larger after service entrance:
a. Non-softened cold water:
1) Schedule 10 stainless steel pipe and joints, ASTM 312, A 778 or B36.19 as allowed by code.
2) Copper, type L, with soldered joints and wrought copper or cast brass fittings.
3) Copper, type L, with roll groove joints and wrought copper or cast brass fittings.
b. Hot water and soft water:
1) Schedule 10 stainless steel pipe and joints, ASTM 312, A 778 or B36.19 as allowed by code.
2) Copper, type L, with solder joints and wrought copper or cast brass fittings.
3) Copper, type L, with roll groove joints and wrought copper or cast brass fittings.

B. Drainage piping (soil, waste, vent, indirect, and storm):
1. Above grade:
a. Cast iron, hubbed pipe and fittings with lead and oakum or elastomeric push joints, as allowed by code.
b. Cast iron, hubless pipe, fittings, and elastomeric sealing sleeves with stainless steel or cast iron clamps, as allowed by code.
c. Copper (type DWV or heavier), with soldered joints and wrought copper or cast brass drainage and vent fittings, as allowed by code.
2. Below grade:
a. 2 IN diameter or larger.
b. Cast iron, hubbed pipe and fittings with lead and oakum or elastomeric push joints, as allowed by code.
c. Cast iron, hubless pipe, fittings, and elastomeric sealing sleeves with stainless steel or cast iron clamps, as allowed by code.

2.3 BACKFLOW PROTECTION DEVICES

A. Backflow protection devices, general:
1. Approved by local Public Utilities Bureau and the state Environmental Protection Agency.

B. Reduced Pressure Principle Backflow Preventer (BFP):

1. Two check valves, test cocks, pressure differential relief valve, isolation valves and accessories assembled as an integral unit, horizontally mounted. Tested and certified in conformance with ASSE Standard No. 1013.
2. Threaded ends: 2 IN and smaller.
3. Flanged ends: 2-1/2 IN and larger.
4. Provide 3/4 IN drain line from relief to floor drain, floor sink, mop sink, or service sink.
5. Isolation valves:
   a. 2 IN and smaller: Ball valve.
   b. 2-1/2 IN and larger:
      1) OS&Y.
   c. Provide No. 1 test cock on inlet valve.
6. Size BFP's to have a pressure loss less than 14 PSI at flows indicated below (refer to plans for pipe sizes):
   a. 1/2 IN pipe: 2.2 GPM.
   b. 3/4 IN pipe: 6 GPM.
   c. 1 IN pipe: 13 GPM.
   d. 1-1/4 IN pipe: 22 GPM.
   e. 1-1/2 IN pipe: 35 GPM.
   f. 2 IN pipe: 75 GPM.
   g. 2-1/2 IN pipe: 125 GPM.
   h. 3 IN pipe: 170 GPM.
   i. 4 IN pipe: 315 GPM.
   j. 6 IN pipe: 720 GPM.
   k. 8 IN pipe: 1250 GPM.
   l. 10 IN pipe: 1965 GPM.

2.4 CLEANOUTS

A. Cleanouts, general:
   1. Provide flashing collars and clamps for CO bodies being installed in floors with finishes installed over waterproofing.
      a. Coordinate with Division 09 and Room Finish installers.
   2. Dimensions are nominal.
   3. Body material (unless indicated otherwise): Coated cast iron.
   4. Cleanout plugs:
      a. Extra heavy, threaded, tapered, brass plug with solid hexagonal nut.
      b. Comply with Plumbing Code.
      c. Provide with American Standard pipe threads.
   5. Cleanouts on lines completely accessible from within pipe chases do not require covers.
   6. Cleanouts in exposed piping in equipment rooms do not require special covers.

B. Interior Floor Mounted Cleanouts:
   1. Extra heavy, flanged, cast iron ferrule, tapped for cleanout plug with spigot or inside caulk outlet.

C. Example:
   1. Two piece, threaded, adjustable housing.
      a. ANSI load class: Light duty, unless noted otherwise.
      b. Example: Wade 6000.
   2. Top and cover as specified below by floor finish.
      a. Resilient tile and sheet finish: Round flange top with scoriated cover.
      b. Ceramic tile finish: Square flange top with scoriated cover.
      c. Poured finish: Round, wide flange top with scoriated cover.
      d. Carpet finish: Round top with standard top tapped for carpet marker bolt.
      e. Terrazzo finish: Round top with recessed for terrazzo cover.
      f. Quarry tile finish: Square, heavy duty top with heavy duty scoriated cover.
      g. Concrete finish in unfinished areas:

1) Heavy, round frame; satin bronze, scoriated tractor top.
2) ANSI load class: Heavy duty.
3) Example: Wade 6000Z.

D. Cleanouts in vertical piping:
1. Tapped cleanout tee.
2. Extra heavy, threaded, brass plug with solid hexagonal nut.

E. Cleanouts in hubs of combination wye and eighth bends or wyes.
1. Tapped spigot.
2. Extra heavy, threaded, brass plug with solid hexagonal nut.

F. Cleanouts at ends of hubless combination wye and 1/8th bends or wyes.
1. Blind plug.

G. Cleanouts at locations of holding cells.
1. Provide pinned cleanout at location of all holding cells serving combination fixture in Mechanical Access Room.

H. Covers over cleanouts in concealed vertical piping:
1. Square, nickel bronze frame with secured, smooth, stainless steel access cover.
2. 6 x 6 IN for pipe sizes 4 IN and less.
3. 9 x 9 for pipe sizes 5 IN and larger.
4. Example: Wade W-8480-S.

I. Exterior cleanouts: See section 20 10 00.

2.5 DRAINS

A. Drains - General:
1. Provide flashing clamps with seepage openings for drain bodies with flashing collars being installed in floors with finishes installed over waterproofing.
   a. Coordinate with Division 09 and Room Finish installers.
2. Provide underdeck clamps for drain bodies except those installed in slabs on grade.

B. Air Gap Fittings:
1. Inlet: Female IPS or collar with set screw.
2. Outlet: Spigot or IPS.
3. Material: Cast iron or bronze.
4. Minimum air gap area: 2 times inlet area.
5. Examples: Jay R. Smith 3950 series.

C. Floor drains:
1. General:
   a. Dimensions are nominal.
   b. Provide trap primer taps where trap primer valves are required: See paragraph on trap primer valves.
   c. Material (unless indicated otherwise): Coated cast iron.
2. FD-1:
   a. 12 IN diameter flashing collar.
   b. Adjustable top.
   c. 8 IN diameter, removable, non-tilt tractor grate.
   d. Cast iron strainer.
   e. Example: Wade 1340TD.
3. FD-2:
   a. 10 IN diameter flashing collar.
   b. Reversible flashing clamp with seepage openings and tapped opening for strainer body.
   c. Threaded strainer body.
   d. 6 IN square, secured, satin nickel bronze, removable strainer.
   e. Example: Wade 1100G.

4. FD-4:
    a. 12 IN diameter flashing collar.
    b. Adjustable top.
    c. 8 IN diameter, Vandal proof secured grate.
    d. Satin nickel bronze, removable strainer.
    e. Example: Wade 1340VP.

D. Floor sinks:
1. General:
    a. Dimensions are nominal.
    b. Provide trap primer taps where trap primer valves are required: See paragraph on trap primer valves.
    c. Material, unless indicated otherwise) Coated cast iron.
    d. Provide flashing collars.
2. FS-1:
    a. Dimensions: 12 x 12 x 6 IN floor sink with square top.
    b. Material of construction: 304 stainless steel.
    c. Stainless-steel sediment basket, same grade as body.
    d. Grate:
        1) Removable, full size, anti-tilt type.
        2) Material of construction: stainless steel, same grade as body.
        3) Size: 10 IN square.
    e. Example: Jay R. Smith 9692.
3. FS-1B:
    a. 12 x 12 x 6 IN floor sink with square top.
    b. Material of construction: 304 stainless steel.
    c. Sediment basket: stainless steel, same grade as body.
    d. Grate:
        1) Removable, three quarter size, anti-tilt type.
        2) Material of construction: stainless steel, same grade as body.
        3) Size: 10 IN square.
    e. Example: Jay.R Smith 9692.

2.6 DRIP PANS OVER CRITICAL AREAS

A. Drip pans:
1. Field or shop fabricated: See detail.

2.7 TRAPS

A. Traps, general:
1. Cast brass or cast iron, one piece pattern, 3 IN minimum seal.
2. Same material, coating, and finish as piping system into which they are installed except traps 2 IN NPS and under, not buried in earth, shall be cast brass with union and cleanout.
3. Place trap cleanouts in accessible locations.

B. Provide deep seal traps for drain bodies in ventilation housings: Traps need to maintain seal against static pressure in fan housing.

C. Traps for drains with buried outlet: Cast iron P-traps, unless otherwise indicated.

2.8 VALVES

A. Balancing valves, constant flow control:
1. Factory calibrated, direct acting, automatic pressure compensating.
2. Control flow rates within 5 percent of flow rating over operating pressure differential range.
    a. Set flow rating according to pipe sizes indicated on plans:
        1) 1/2 IN: 1.0 GPM.
        2) 3/4 IN: 2.5 GPM.

3) 1 IN: 6 GPM.
4) 1-1/4 IN: 9 GPM.

3. Pressure differential range:
   a. 4-57 PSID.
4. Threaded brass or copper sweat body with stainless steel internal parts.
5. Provide a metal identification tag with chain for each installed valve.
   a. Identify zone or location, valve model number, flow rate, direction of flow, and differential pressure range.
6. Provide with integral unions to allow field exchange of internal components without removing valve body from pipeline.
7. Provide manual valve upstream and downstream of each valve.

B. Check Valves:
   1. 2 IN and smaller: V-24 or V-25.
   2. 2-1/2 IN and larger: V-28 or V-29.

C. Manual Valves, Potable Water:
   1. 2 IN and less: V-13 or V-14.
   2. 2-1/2 to 4 IN:
   3. Balancing cocks:
      a. Constant flow control balancing valves.
      b. Red White Valve Corp. Model 9517.

D. Pressure Reducing Valves:
   1. Use pilot operated or direct acting PRV based on pipe size indicated on plans.
      a. 2 IN and smaller: direct acting.
      b. 3 IN and larger: pilot operated.
   2. Direct acting PRV.
      a. Bronze bodied, diaphragm and spring type valve with integral thermal bypass and removable, stainless steel strainer.
      b. Size PRV's to have a maximum fall off pressure of 15 PSIG at flows indicated below (refer to plans for pipe sizes):
         1) 1/2 IN pipe: 2.2 GPM.
         2) 3/4 IN pipe: 6 GPM.
         3) 1 IN pipe: 13 GPM.
         4) 1-1/4 IN pipe: 22 GPM.
         5) 1-1/2 IN pipe: 35 GPM.
         6) 2 IN pipe: 75 GPM.
   3. Pilot operated PRV.
      a. Hydraulically operated, pilot controlled diaphragm type valve.
         1) Pilot control: Direct acting, adjustable, spring loaded, normally open.
      b. Single removable seat and resilient disc.
      c. Fixed orifice in control system.
      d. Pressure rating: 125 class.
      e. Temperature rating: 180 degF.
      f. Valve body: Cast iron ASTM A48.
      g. Stainless-steel trim.
      h. Provide thermal relief if PRV is installed on cold-water side of water heater.
      i. Adjustment range: 15 to 75 PSI.
      j. Pipe size indicated on plans: 3 IN.
         1) Min PRV flow rate: 15 GPM.
         2) Normal maximum flow rate: 150 GPM.
         3) Maximum intermittent flow rate: 260 GPM.
      k. Pipe size indicated on plans: 4 IN.
         1) Min PRV flow rate: GPM.
         2) Normal maximum flow rate: 310 GPM.
         3) Maximum intermittent flow rate: 475 GPM.

l. Pipe size indicated on plans: 6 IN.
   1) Min PRV flow rate: 50 GPM.
   2) Normal maximum flow rate: 720 GPM.
   3) Maximum intermittent flow rate: 1000 GPM.
m. Pipe size indicated on plans: 8 IN.
   1) Min PRV flow rate: 115 GPM.
   2) Normal maximum flow rate: 1250 GPM.
   3) Maximum intermittent flow rate: 1870 GPM.
n. Pipe size indicated on plans: 10 IN.
   1) Min PRV flow rate: 200 GPM.
   2) Normal maximum flow rate: 1965 GPM.
   3) Maximum intermittent flow rate: 2950 GPM.

2.9 WATER HAMMER ARRESTERS

A. Engineered, and certified in accordance with Plumbing and Drainage Institute (PDI) Standard WH-201.

B. Type and construction:
   1. Bellows type and constructed entirely of stainless steel.
   2. Piston type is not acceptable.

C. Water hammer arrestors shall be bellows type and constructed entirely of stainless steel.

PART 3 - EXECUTION

3.1 GENERAL

A. General:
   1. Install piping as indicated and to provide fixtures and items of equipment with proper drainage, vent, and water connections as required by governing codes.
   2. Hold piping as close to structure as possible to maintain maximum head room.
   3. Run piping concealed wherever possible.
   4. Under no circumstances reduce pipe size indicated without written consent of Architect.
   5. Size branches to individual fixtures as scheduled.
   6. Consult the following before roughing in piping:
      a. Manufacturer's data.
      b. Large scale Architectural, and Mechanical Drawings of rooms containing equipment and plumbing fixtures.
   7. Stub piping through wall directly behind item being served (e.g., equipment, plumbing fixtures, vending machines).
      a. Cap and protect until such time as installation is performed.
      b. Exception: Upon approval of Architect, piping mains and/or branches may be run in lab benches, in built in counters, and in cabinet work.
   8. Plug or cap piping immediately after installation.
   9. Install chromed escutcheons on finished area sides of pipe penetrations.
      a. Secure escutcheons so they make contact with floor, wall, or ceiling.
   10. Install equipment in accordance with manufacturer's instructions.
   11. Connect equipment furnished by Owner or other divisions in accordance with Section 20 05 00.
   12. Install piping supports, sleeves, and seals as indicated in Section 20 05 29.

3.2 DOMESTIC WATER PIPING SYSTEMS

A. General:
   1. Install plumbing without cross or inter connections between potable and non-potable lines.

2. Provide unvalved system drains on trapped portions of systems: See Section 20 05 19.
3. Provide thermometers and pressure gauges where indicated on drawings: See Section 20 05 19.

B. Backflow Protection Devices.
1. Provide at following locations:
a. At fixtures and equipment as indicated and required by Code.
b. Were specified in Section 22 42 00: Plumbing Fixtures.
2. Pipe drain from reduced pressure principle backflow preventers to drain or mop sink.

C. Balance Hot Water Circulation System.

D. Provide manual isolation valves at following locations.
1. To isolate groups of fixtures and equipment on branch runouts from piping mains.
2. To isolate individual holding cells in the mechanical access spaces.
3. On each branch serving a rest room.
4. On inlet and outlet of each equipment.
5. On each branch to hose bib or wall hydrant.
6. At main feed points to domestic water pipe risers.
7. As indicated and as required to adequately service parts of systems and equipment.

E. Provide water hammer arresters on hot and cold water lines in accordance with PDI Standard WH-201 sizing and placement data; the Contractor shall be responsible for sizing of water hammer arrestors in accordance with this standard.

F. Testing of Domestic Water System:
1. Upon completion of system or a section of system, test piping hydrostatically to pressure not less than 50 percent in excess of pipe's working pressure, but in no case less than 150 PSI.
a. System shall hold pressure for 24 hours.
2. Repair leaks or replace defective pipe disclosed by tests.
3. Repeat tests until piping indicates tight.

G. Sterilization of Domestic Water System:
1. Sterilize system as indicated or in accordance with AWWA C652 or CS186.
2. Thoroughly flush potable water systems.
3. After flushing, introduce chlorine or chlorine compound into system with dosage sufficient to give an initial residual chlorine content of 50 PPM.
4. Collect samples from various taps and fixtures throughout buildings during introduction of chlorine to assure uniform distribution.
5. Open and close valves several times.
6. After a 24 HR contact period, flush traces of heavily chlorinated water from systems.
7. After flushing is complete, indicate effectiveness of disinfection by submitting laboratory reports of bacteriological tests on samples taken from system.
8. If unsatisfactory results are obtained, repeat disinfection process until satisfactory.
9. Do not put system into service until tests are approved by Plumbing Inspector.

3.3 DRAINAGE PIPING SYSTEMS

A. General:
1. Changes of direction and junctions: Make with wye fittings and eighth bends.
a. Use sanitary tee fittings in vertical pipe only.
1) Sanitary crosses not allowed.
2. Provide P-trap for each direct waste pipe connection to equipment.
3. Trap fixtures as required by governing code.
4. For ice makers, provide either of the indirect drain options listed below:
a. Floor sink.
b. Dedicated, under counter P-trap.
5. Provide air gaps at indirect drains.

B. Slopes:

1. Install horizontal soil, waste, and storm lines with following slopes:
    a. 3 IN and smaller pipes:
        1) 1/4 IN/FT.
    b. 4 IN and larger pipes:
        1) 1/8 IN/FT.
    c. Slopes indicated on plans override those indicated here.

C. Vents:
1. Run vent stacks parallel to soil and waste stacks to receive branch vents from fixtures.
    a. Each vent stack shall originate from a soil or waste stack at its base.
2. To permit proper flashing, offset through the roof piping away from walls on roof before passing through roof.
3. Carry vent stacks 4 IN and larger full size through roof.
4. Install vent lines so they will drain and not trap water.
5. Where possible combine soil, waste or vent stacks before passing through roof to minimize roof openings.
6. Where minimum vent through roof size is larger than vent size, provide increaser minimum of 12 IN below roof line.
    a. Minimum vent through roof size:
        1) 4 IN.
7. Extend vent stacks at least 12 IN above roofing.

D. Provide cleanouts on drainage piping as indicated below and on plans.
1. Locations:
    a. At location of all holding cells serving combination fixture in Mechanical Access Room.
    b. At dead ends.
    c. At changes of direction greater than 45 DEG.
    d. At junction of building drain and building sewer.
    e. 36 IN to 48 IN above finished floor in vertical piping that connects to horizontal soil, waste, or storm piping immediately below in ceiling space or under grade.
    f. As test tee to receive test plugs in each riser at least every other floor.
    g. At maximum 50 FT intervals in horizontal 4 IN and smaller drains.
    h. At maximum 100 FT intervals in horizontal, 5 IN and larger drains.
2. Sizes:
    a. 4 IN diameter and smaller piping: Match pipe size.
    b. 5 IN diameter and larger piping: Not less than 4 IN.
3. Where cleanouts occur in concealed spaces, provide with extensions to wall or to floor above.
    a. Make extensions using long sweep ells or wye and eighth bends.
4. Where cleanouts are indicated in ceiling spaces above critical areas, extend cleanouts through floor above.
5. Install carpet marker bolts after carpet installation.

E. Install piping and drains to allow for flashings provided under Roofing System section.
1. Coordinate with Roofing installer.

F. Area Drains, Floor Drains and Floor Sinks:
1. At locations with waterproofing: Set top of flashing collar 1/2 IN below level of waterproofing.
2. At locations without waterproofing: Place drain integrally with poured concrete. Set top of drain flush with finished floor.
3. Set over P-traps.

G. Drains in Plenums:
1. Indirectly waste plenum drains to receptor outside of plenum.

H. Drip Pans:

1. Provide under drainage piping that runs over critical areas.
2. Critical areas include the following:
   a. Electrical Rooms.
   b. Comm Rooms.
3. Provide drain piping from pans. Spill drain piping to drain in exposed area.

I. Testing of Drainage Piping Systems:
   1. Do not insulate, conceal, or install furring around pipe until it has been tested to satisfaction of Owner and Plumbing Inspector.
      a. If inspection or test indicates defects, replace such defective work or material and repeat inspection and tests.
   2. Test piping at completion of installation of each stack or section of piping.
      a. Fill system with water to highest point and check joints and fittings for leaks.
      b. Eliminate leaks before proceeding with work or concealing piping.
      c. Minimum test height: 10 FT.
      d. Make repairs to piping with new material.
      e. Peening and chiseling of holes or screwed joints is not allowed.

END OF SECTION

SECTION 22 11 23
PLUMBING PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Plumbing Pumps, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Circulating pumps.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Pipe and fittings standards: See Section 20 11 00.

B. Manual-valve and check-valve standards: See Section 20 05 23 (for valves labeled "V-__").

C. Standards:
   1. UL 778: Motor Operated Water Pumps.

1.3 SUBMITTALS

A. Product Data:
   1. Circulating pumps.
      a. Include pump curves with point of operation indicated.

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction reports.

1.4 WARRANTY

A. Eighteen (18) months from start up.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Circulating pumps:
   1. Base:
      a. Bell & Gossett, ITT.
   2. Optional:
      a. Armstrong Pumps.
      b. Grundfos.
      c. Taco.
      d. Thrush.
      e. Aurora.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Pumps - General:
   1. Motors: Section 20 05 00.
   2. Motor data: As scheduled.
   3. Pump capacities: As scheduled.
   4. Provide disconnects.

5. Provide starters for 3-phase motors.
6. Basins: As detailed.

B. Vibration Isolation:
1. Provide in accordance with Section 20 05 50.

2.3 CIRCULATING PUMPS

A. Circulating Pumps:
1. In-line centrifugal.
2. Pump casing and impeller: Bronze, designed for domestic water circulating.
3. Fractional-horsepower pumps: Seal-less.

PART 3 - EXECUTION

A. Install as indicated and in accordance with manufacturer's instructions and recommendations.

B. Furnish piping, isolation valves, check valves, and fittings per manufacturer recommendation.

C. Provide manual isolation valves at following locations:
1. On inlet and outlet of each circulating pump.
2. As indicated and as required to adequately service parts of systems and equipment.

D. Provide check valve at outlet of each pump.

E. Valve Requirements:
1. See Section 22 10 16.

END OF SECTION

SECTION 22 11 26

PACKAGED DOMESTIC WATER PRESSURE BOOSTER SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Packaged Domestic Water Pressure-Booster System, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Booster pumps.
      a. Variable speed system.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. Hydraulic Institute.
   2. NEMA - National Electrical Manufacturers Associations.
   3. UL - Underwriters Laboratories.
   4. NEC - National Electric Code.

B. Manufacturer Qualifications:
   1. UL listed as control panel manufacturer.
   2. Written and operational Quality Assurance program.
   3. Minimum ten (10) years experience in manufacturing and application of pumping systems.
   4. Accepting full responsibility for proper pressures and flows in the entire system.

C. Factory Tests:
   1. Hydrostatically test assembled pumping systems to 200 PSIG for a minimum of one hour.
   2. Test control system, and simulate sequences and alarms.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Packaged domestic-water pressure-booster system.
      a. System arrangement and dimension drawings.

B. Product Data:
   1. Packaged domestic-water pressure-booster system.
      a. System design information sheet.
      b. Description of system operation.
      c. Pump material and construction drawing.
      d. Pump curves indicating design points.
      e. Control wiring diagram.
      f. Catalog information on valves, strainers, and control components.

C. Contract Closeout Information:
   1. Operating and maintenance data.
      a. System design information sheet.
      b. Description of system operation.
      c. Packaged system dimension and general arrangement drawing.
      d. Electrical power and control wiring diagram.
      e. Bill of material.
      f. Pump operation and maintenance instructions.
      g. Special electrical component operation instructions.
   2. Factory-test reports.

1.4 DELIVERY OF EQUIPMENT

A. Configure system to be deliverable and installable through passages and doorways as indicated on Architectural drawings.
   1. Factory disassemble systems for shipping and field assembly.
   2. Provide assembly instructions.

B. Remove drain plugs from equipment where possibility of freeze damage may exist.

C. Comply with manufacturer's instructions for rigging, unloading, and transporting equipment.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Packaged Domestic Water Pressure-Booster System:
   1. Base:
      a. Bell and Gossett.
   2. Optional:
      a. Systecon.
      b. Aurora Pump.
      c. Canariis.
      d. Unosource Control.

B. Pumps:
   1. Base:
      a. Goulds Pumps.
   2. Optional:
      a. Allis-Chalmers, ITT
      b. Armstrong Pumps.
      c. Aurora Pump.
      d. Bell & Gossett, ITT.
      e. PACO Pumps.
      f. Peerless Pump.
      g. Taco.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Packaged System:
   1. Provide components factory assembled, piped, and wired. Include the following:
      a. Electrical control panel.
      b. Pumps.
      c. Motors: Section 20 05 00.
      d. Piping, fittings, and valves: Section 22 10 16.
      e. Piping specialties: Section 20 05 19.
         1) Pressure gauges.
         2) Unions.
         3) Stainless steel check valves
         4) System drains.
         5) Flow meter
      f. Mechanical sound, vibration & seismic control: Section 20 05 50.
         1) Vibration base with isolators.
         2) Flexible connectors.
   2. Provide one suction and one discharge pipe connection, and one electrical power connection.
   3. Provide sensor and transmitters constructed of stainless steel to operate VFD.

4. If package needs to be broken down to allow transportation to installed location, construct it to be broken down modularly.
    a. Modular construction:
        1) Field reconnections must be by unions, flanges, bolts, screws, and electrical plugs.
        2) Reconnection requiring cutting, welding, soldering, multiple connections to screw terminals, is not allowed.
5. Assemble package so ample room exists within the package for servicing of components.

B. Electrical Control Panel:
1. UL listed.
2. NEMA 1 enclosure.
3. Single door interlocked disconnect switch with individual circuit breakers.
4. Hand-off-auto switches for each pump.
5. Control circuit transformer with protected primary and secondary.
6. Power on light.
7. Run light for each pump, and contact for remote output.
8. Elapsed run-time meter for each pump.
9. Low-suction cutout with alarm and contact for remote output.
10. Pump failure alarm light, reset pushbutton, and contact for remote output.

C. Pumps:
1. Type:
    a. Centrifugal.
        1) Inline.
    b. Flex-coupled.
    c. Bronze-fitted.
2. Construction:
    a. Cast-iron casing, casing wear rings, stainless steel impeller, shaft sleeve, mechanical seal.
    b. Maximum pump casing pressure: 230 PSIG.
    c. Designed so that pump can be serviced without moving motor and without disconnecting piping.
3. Performance:
    a. Each pump shall perform as scheduled and as specified.
    b. Pumps shall not overload at any point on the pump curves.
4. Capacity: As scheduled.

D. Piping, Fittings, Manual Valves, and Piping Specialties:
1. Epoxy phenolic lined steel piping and fittings.
2. Provide isolation valves on suction and discharge from each pump.
3. Provide stainless steel spring-loaded check valve on discharge from each pump.
4. Supports:
    a. See Section 20 05 29.
    b. Provide supports for the following:
        1) Suction header.
        2) Suction and discharge piping on each pump.
        3) Discharge header.
    c. Support piping independently of pump connections.
    d. Arrange pipe supports to permit field installation of insulation: Section 20 07 00.
5. Pressure gauges on suction and discharge header.
6. Shut-off valves on control sensing lines and gauges.

2.3 VARIABLE SPEED PACKAGED SYSTEM

A. Variable Speed Packaged System: In addition to general packaged system requirements, provide the following:
1. Additional control panel features.
2. Variable frequency drives.

3. Isolation transformers.

B. Electrical Control Panel:
1. Designed to start and stop pumps and modulate speed to meet system demands.
2. Monitor system pressure at remote transmitters and send 4-20 mA DC signals via a pair of wires to a receiver/controller in control cubicle.
3. Receiver/controller: Field programmable.
   a. Direct digital type.
   b. Data entry in engineering units by keypad.
   c. PID control: Capacity to select signal that has deviated farthest from setpoint from up to 10 transmitters.
4. Start pumps on a drop in system pressure and stop after an adjustable minimum run time.
   a. Provide no-flow probe to control lead pump shutdown.
5. Start pumps manually and adjust speed automatically or manually using H-O-A switch and manual speed potentiometer for each VFD.
6. Control sequence enclosure:
   a. High and low system pressure alarms and contacts for remote outputs.
   b. Lead pump selector switch and manual alternation.
   c. Pump sequencing logic.
   d. Transient snubbers on inductive loads in panel.
   e. Receiver/controller.
   f. Interface controls for variable frequency drives.
7. Provide signal isolating buffers on internal and external 4-20mA circuits where utilized by more than 2 devices.
8. Remote pressure transmitters:
   a. Self-contained, variable capacitance type.
   b. Install transmitter(s) in following locations:
      1) Cold-water main downstream of pressurized bladder tank.

C. Variable Frequency Drives:
1. See Section 25 23 00.

2.4 DEMONSTRATION

A. System manufacturer or manufacturer’s representative: Provide start-up and adjustment service for packaged pumping system.

B. System manufacturer or manufacturer’s representative: Provide a minimum 4 hours of training for the owner's personnel on the operation and maintenance of the packaged pumping system.

C. System manufacturer: Have factory trained authorized service agency located within 35 miles of project site.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install pressure booster system in accordance with manufacturer's recommendations and instructions.

B. Align pump and motor shafts to within manufacturer's recommended tolerances prior to system start-up.

C. Pipe drain lines to floor drain.

D. Provide wiring between pressure transmitters and receiver/controller, (variable speed system only).

END OF SECTION

SECTION 22 33 00
DOMESTIC WATER HEATERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Domestic Water Heaters, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Factory testing: Subject tank and elements to hydrostatic test pressure, 150 percent in excess of working pressure. Certify that components are free of leaks.

B. Manufacturing standard: ASME Pressure Vessel Code.

1.3 SUBMITTALS

A. Product Data:
   1. Water heaters.

B. Contract Closeout Information:
   1. Owner instruction report.
   2. Operating and maintenance data.
      a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Electric Storage Water Heater.
   1. Base:
      a. AO Smith Water Products.
   2. Optional:
      a. Rheem Water Heaters.
      b. Ruud Water Heater.
      c. State.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS - GENERAL

A. High temperature limits shall prevent delivery of water that is hotter than that selected for delivery from heater.

B. Concrete linings shall comply with MIL-T-12295.

C. Unless indicated otherwise, water pressure drop through heater shall not exceed 10 PSI.

2.3 ELECTRIC STORAGE WATER HEATER

A. Electric Storage Water Heater.
   1. Factory-assembled, packaged commercial water heater with storage tank, heating elements, controls, and other components as indicated.

2. Completely factory assemble water heater so that installation involves only setting, leveling, anchoring, and connection of piping and electrical services.
3. Designed for potable water service.
4. UL listed and NSF approved.

B. Scheduled Information:
1. Entering water temperature.
2. Leaving water temperature.
3. Recovery capacity.
4. Electrical requirements.
5. Power: BTUH.
6. Storage tank capacity.

C. Storage Tank:
1. Labeled ASME Code construction.
   a. Minimum working pressure of 125 PSI for tanks 65 gallons and larger.
   b. Minimum working pressure of 150 PSI for tanks smaller than 65 gallons.
2. Vertical, floor-mounted.
3. Minimum pressure rating:
   a. 150 PSI working pressure.
   b. 300 PSI test pressure.
4. Tank handhole cleanout.
5. Brass drain valve.
6. Insulation: R-16 complying with ASHRAE 90.1.
7. Steel outer jacket with manufacturer's standard enamel finish.
8. Glass lined steel tank with anode rods.

D. Heating Elements:
1. Heavy duty and resistant to oxidation and scaling.
2. Easily replaceable.
3. Fused in accordance with NEC and UL.

E. Controls:
1. Fused, 120V control circuit.
2. Adjustable leaving water temperature range: Off and 95-140 degF.
   a. Provide one thermostat per heating element.
3. High-temperature limit with adjustable set point.
4. Low-water cut-off.
5. Immersion thermostat.
6. Magnetic contactors.

F. Other Components:
1. Temperature/pressure relief valve.
2. Pressure gauge.
3. Temperature gauge.

2.4 TEMPERATURE/PRESSURE RELIEF VALVES

A. Temperature/Pressure Relief Valves.
1. AGA and ASME-approved, tight-shutoff, self-closing, bronze-bodied.
2. Threaded inlet and outlet.
3. Test lever.
4. Capacity: Same power as water heater. See schedule.
5. Relief setting: 210 degF/150 PSIG unless otherwise required by code.

PART 3 - EXECUTION

3.1 GENERAL

A. Install units in accordance with manufacturer's instructions.

B. Install units to allow complete access for servicing including removal of heater sections.

C. Set thermostat so heater will deliver scheduled leaving water temperature.

END OF SECTION

SECTION 22 42 00
PLUMBING FIXTURES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Plumbing Fixtures, as indicated, in accordance with provisions of Contract Documents.

B. Definitions:
   1. Aerator: Device that mixes room air with faucet's water stream.
   2. Ledge mounted faucet: Faucet with body mounted on top of faucet ledge and covered by faucet housing or single escutcheon.
   3. Bottom-mounted faucet: Faucet with body mounted beneath faucet ledge; each penetration is covered by single escutcheon.
   4. Semi-cast: Fittings, return bends, and nuts are cast brass. Waste arms and wall bends are tubular.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manual Valve Standards:
   1. See Section 20 05 23, for valves labeled "V-__".

B. Design and Installation Standards:
   1. ANSI Z358.1: Standard for Emergency Eyewash and Shower Equipment.
   2. ASSE 1016: Individual Thermostatic Pressure Balancing, and Combination Pressure Balancing and Thermostatic Control Valves for Individual Fixture Fittings.
   3. ASSE 1017: Temperature Actuated Mixing Valves for Hot Water Distribution Systems.
   4. NSF standard: Comply with NSF 61: “Drinking Water System Components-Health Effects”, for fixture materials that will be in contact with potable water.

C. Accessibility Manufacturing and Installation Standards:
   1. Americans with Disabilities Act (Public Law 101-336).
   2. ANSI-A117.1, current edition.
   3. Local authorities.
   4. State authorities.

1.3 SUBMITTALS

A. Product Data:
   1. Assemble submittals by mark number. Include sufficient information to verify compliance with descriptions.
   2. Where model numbers differ from descriptions, submit to meet description requirements:
      a. Electric water coolers.
      b. Hose bibbs.
      c. Lavatories.
      d. Mixing valves.
      e. Sinks.
      f. Standpipe and supply boxes.
      g. Urinals.
      h. Security Fixtures
      i. Water closets.
      j. Undersink protective covers.

B. Contract Closeout Information:
   1. Operating and maintenance data.

a. See Section 01 78 23.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Electric Water Coolers and Drinking Fountains:
   1. Base:
      a. Elkay Manufacturing.

B. Single Lever Mixing Faucets:
   1. Base:
      a. American Standard Plumbing.
   2. Optional:
      a. Chicago Faucet.
      b. T&S Brass & Bronze Works.
      c. Kohler.

C. Two Handled Faucets:
   1. Base:
      a. American Standard Plumbing.
   2. Optional:
      a. Chicago Faucet.
      b. T&S Brass & Bronze Works.
      c. Delta Commercial.
      d. Crane Plumbing.
      e. Eljer Plumbingware.
      f. Kohler.

D. Molded Stone, Precast Terrazzo, Fiberglass Reinforced Polyester Fixtures:
   1. Base:
      a. Fiat.
   2. Optional:
      a. Creative Industries Terrazzo Products.
      b. Stern and Williams.
      c. Swan.
      d. Mustee & Sons, EL.

E. Stainless Steel Fixtures:
   1. Base:
      a. Elkay Manufacturing.
   2. Optional:
      a. Just Manufacturing.
      b. Southern Kitchens.

F. Security Fixtures:
      a. Base:
         1) Willoughby
      b. Optional:
         1) Metcraft
         2) Acorn Engineering

G. Vitreous China Fixtures:
   1. Base:
      a. American Standard Plumbing.
   2. Optional:
      a. Eljer Plumbingware.
      b. Kohler.

H. Fixture Carriers:
   1. Base:
      a. Wade.
   2. Optional:
      a. Watts/Ancon.
      b. Jonespec.
      c. Josam.
      d. J R Smith.
      e. Zurn Industries.

I. Flushometer Valves:
   1. Base:
      a. Sloan Valve.
   2. Optional:
      a. Coyne & Delany.
      b. Zurn Industries.

J. Hose Bibbs:
   1. Base:
      a. Chicago Faucet.
   2. Optional:
      a. Acorn Engineering.
      b. Delta Commercial.
      c. Crane Plumbing.
      d. Croker West.
      e. Sloan Valve.
      f. Speakman.
      g. T&S Brass & Bronze Works.
      h. Woodford Manufacturing.

K. Thermostatic Mixing valves:
   1. Base:
      a. Symmons.
   2. Optional:
      a. Lawler Manufacturing.
      b. Leonard Valve.
      c. Powers.

L. Standpipe and Supply Boxes:
   1. Base:
      a. Acorn Engineering.
   2. Optional.
      a. Amsco.
      b. Bradley.
      c. Guy Manufacturing.

M. Trim:
   1. Base:
      a. McGuire Manufacturing.
   2. Optional:
      a. American Standard Plumbing.
      b. Brass-Craft Manufacturing.
      c. Chicago Faucet.
      d. Crane Plumbing.
      e. Dearborn.
      f. Eljer Plumbingware.
      g. Elkay Manufacturing.
      h. Just Manufacturing.

i. Kohler.
j. T&S Brass & Bronze Works.

N. Water Closet Seats:
1. Base:
a. Beneke.
2. Optional:
a. Bemis.
b. Centoco.
c. Church.
d. Olsonite.
e. Sperzel.

O. Undersink Protective Covers:
1. Base:
a. Truebro.
2. Optional:
a. McGuire.

P. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Construct or equip fixtures with air gap or anti-siphon devices to prevent siphoning non-potable water into potable water supply system.

B. Piping exposed in finished areas including fittings and trim:
1. See Section 22 10 16.

C. Dimensions:
1. Dimensions are Nominal.
2. Multiple dimensions:
a. First dimension: Side-to-side.
b. Second dimension: Front-to-back.
c. Third dimension: Top-to-bottom.

D. Manufacture accessible fixture assemblies to meet requirements of accessibility standards.

E. Faucets - General:
1. Following general conditions apply unless detailed otherwise in specific descriptions:
a. Renewable cartridges with integral seats (or renewable seats and stems).
b. Materials:
1) Brass, bronze, copper, stainless steel, ceramic.
2) Plastic components are not acceptable.
c. Finish:
1) Chrome.
d. Gooseneck spouts:
1) Discharge at least 5 IN above rim of fixture.
e. Electric, sensor-operated faucets:
1) Mount transformer and control panel in concealed but accessible location.
2) Coordinate with Electrical and Casework contractors.
f. If mixing valve is not included in faucet description, provide a tempering, under-counter mixing valve. Mechanical mixing valves shall not be used.
g. Comply with NSF 61- “Drinking Water System Components – Health Effects” for fixture materials that will be in contact with potable water.

F. Flow Control Devices - General:
1. Provide flow control devices with indicated maximum flow rates on listed fixtures:
a. Private lavatory: 2.2 GPM.
b. Public lavatory:

1) Non-metering: 0.5 GPM.
2) All locations shall be considered public, except as specifically identified above for private.

c. Sinks: 2.2 GPM at 60 PSI.
d. Showers: 2.5 GPM at 80 PSI.

2. Material: Brass.
3. Finish: Chrome.
4. Accomplish controlled flow without aeration of water stream. Aerators are not acceptable unless specifically identified in the faucet description.
5. Flow control devices shall be disinfectable.
6. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.

G. Lavatory Fixtures - General:

1. Following general conditions apply unless detailed otherwise in specific descriptions:

a. Vitreous china and enameled, cast-iron fixtures:

1) Color: White.
2) Overflows: Integral.

b. Stainless steel fixtures:

1) Finish: Softsatin.
2) Type: 302 (18-8) or 304 (18-8).
3) Thickness: 20 GA.
4) Sound deadening that covers complete underside of bowl.

c. Provide integral faucet ledge with holes:

1) Coordinate hole quantities, locations, and centerings with faucet types indicated in fixture descriptions.
2) Provide exact number of holes necessary.

a) Use of faucet hole covers is not acceptable.

H. Mixing Valves - General:

1. Following general conditions apply unless detailed otherwise in specific descriptions:

a. Materials:

1) Brass, bronze, copper, stainless steel, ceramic.
2) Thermostatic mixing valves:

a) Thermostat may contain plastic parts.

3) Escutcheon may be pot metal.

b. Finish of exposed surfaces:

1) Chrome.

c. Hot/cold color coding.
d. Coordinate number of ports with trim indicated in fixture descriptions.

1) Four-port valves:

a) If diverter spout is indicated in fixture description, provide built in choke.
b) If external diverter valve is indicated in fixture description, provide without choke.

e. Comply with NSF 61- "Drinking Water System Components – Health Effects" for fixture materials that will be in contact with potable water.
f. Thermostatic Mixing Valves:

1) ASSE 1017 compliant.
2) Renewable thermostatic and pressure-balance elements.
3) Compensates for changes in both temperature and pressure.
4) Integral checks and service stops.
5) Temperature control with built-in shut off; opens from cold to hot.
6) Single lever handle.
7) Adjustable, temperature-limit stops.
8) "OFF-COLD-HOT" marking in block type letters minimum 7/32 IN high.

I. Sink Fixtures - General:

1. Following general conditions apply unless detailed otherwise in specific descriptions:
    a. Vitreous china: White.
    b. Stainless steel:
        1) Finish: Softsatin.
        2) Type: 302 (18-8) or 304 (18-8).
        3) Sound deadening that covers complete undersides of each bowl.
        4) Thickness:
            a) Sink depth less than or equal to 10 IN: 18 GA.
            b) Sink depth greater than 10 IN: 16 GA.
    c. Molded stone and terrazzo:
        1) Marble chips in reinforced Portland cement.
            a) 7-day compressive strength:
                (1) 3000 PSI.
            b) Exposed surfaces:
                (1) Ground smooth, grouted and sealed to resist staining.
        2) Drain body opening: Integrally cast.
        3) Color:
            a) As selected from manufacturer's standard line by Architect.
    d. Enameled cast-iron:
        1) Color: White.
    e. Countertop sinks:
        1) Self-rimming.
    f. Provide integral faucet ledge with holes:
        1) Coordinate hole quantities, locations, and centerings with the following:
            a) Faucets and trim indicated in fixture descriptions.
            b) Hot-water dispensers.
            c) High-purity water faucets.
        2) Provide exact number of holes necessary.
            a) Use of faucet hole covers is not acceptable.

2.3 ELECTRIC WATER COOLERS

A. Electric Water Coolers – General:
    1. Following general conditions apply unless detailed otherwise in specific descriptions):
        a. Self contained, refrigeration units.
            1) Capacity based on 90 degF room temperature, 80 degF inlet-water temperature, and 50 degF drinking-water temperature.
            2) Air cooled condensing units.
                a) 115V.
                b) Hermetically sealed compressor.
        b. Bubbler drain-pan: Stainless steel.
        c. Stainless steel: Type 304 with satin finish.
        d. Chrome-plated, brass bubbler.
            1) Bubbler guard may be plastic and need not be chrome-plated.
        e. Stream regulator mounted inside cabinet or in bubbler. Regulator shall maintain constant stream height while line pressure varies between 30 and 90 PSI.
        f. Certified lead free as defined by the Safe Drinking Water Act.

B. EWC-1, Accessible, facing forward, dual-level, water bottle filling station:
    1. Fixture:
        a. Wall hung, surface-mounted, dual-level. Self closing push bars on front and sides. Refrigeration unit mounted in cabinet behind and below bubble drain pan. Bottle filling unit shall include an electric sensor for touchless activation with auto 20-second shut-off timer. Bottle filler shall provide 1.1 gpm flow rate with laminar flow to minimize splashing. Provide with 3000-gallon capacity filter with visual monitor to indicate when replacement is necessary.
        b. High efficiency compressor exceeding average market performance by 35%.

c. Minimum Capacity: 8 GPH.
d. Bottle fill station to be located on the lowest elevation drinking fountain.
e. Provide with 48 replacement filters: 51300C_48PK
f. Cabinet finish: Acrylic enamel on 20 GA steel.
   1) Color : Light gray granite vinyl clad steel.
   2) Elkay Model LZSTLG8WS.
g. Fixture carrier: Hanger-plate type.

2.4 FIXTURE CARRIERS

A. Fixture Carriers:
1. Application:
   a. This paragraph describes carriers for wall hung valves and wall hung fixtures except water closets.
   b. See Water Closet article for closet carriers.
2. Carriers consist of uprights, floor anchors, and fixture supports:
   a. Fixture-support types are concealed-arm, exposed-arm, hanger-plate, and clinical-service-sink.
   b. Include associated hardware.
3. Materials:
   a. Coated cast iron.
   b. Steel.
4. Weight of construction: Institutional.
5. Uprights: Rectangular structural steel.
6. Floor anchors:
   a. Non-adjustable cast-iron floor anchors bolted to uprights; or steel-plate floor anchors integrally welded to uprights.
   b. 4-hole anchoring to floor.
7. Concealed-arm fixture supports:
   a. Header couplings:
      1) Vertically adjustable with horizontally adjustable cross tie.
      2) Integral pipe sleeves.
   b. Secure arms to pipe sleeves with threaded or set-screw connections.
   c. Hardware for vitreous china fixtures:
      1) Leveling screws for four corners of fixture.
      2) Non-slip devices to lock fixture into place on arms.
   d. Hardware for cast-iron fixtures:
      1) Threaded eye bolts with leveling hardware.
   e. For flat-slab fixtures requiring set out from wall, provide 2 IN chromed wall escutcheons.
8. Hanger-plate fixture supports:
   a. Bolted attachment to uprights.
   b. Drilled/slotted to match fixture.
   c. Hardware for attaching fixture.
   d. Provide in adequate size and quantity to anchor fixture at every anchoring point on the fixture.
9. Match lengths, mounting locations, and sizes to fixture requirements.

2.5 HOSE BIBBS

A. Hose Bibb – General:
1. Following general conditions apply unless detailed otherwise in specific descriptions:
   a. Material: Brass.
   b. Finish: As indicated.

B. HB-1, Polished Brass Hose Bibb with Vacuum Breaker:
1. Fixture:

a. 1/2 IN IPS male inlet, adjustable / removable wall flange, lever handle, 3/4 IN garden hose outlet.
   1) Model: T&S Brass B-0718.
2. Vacuum breaker:
   a. Garden hose vacuum breaker, 3/4 in female garden hose inlet & male outlet.
      1) Model: T&S Brass B-5550-10.

2.6 LAVATORIES

A. L-1, Lavatory, Wall Hung:
   1. Fixture:
      a. 21 x 18 IN, wall hung, vitreous china, backsplash, concealed arm support.
         1) American Standard Plumbing Lucerne 0356.015.
      b. Fixture carrier: Concealed-arm type.
   2. Faucet:
      a. Bottom mounted, 8 IN spread, two 4 IN wristblades 5 IN reach fixed gooseneck.
         1) American Standard Plumbing Heritage 6830.000.
   3. Trim:
      a. Supplies: Chrome, 3/8 IN OD, soft copper tube, loose key stops, escutcheons.
      b. Grid drain: Chrome, 1-1/4 IN cast brass with 17 GA x 1-1/4 IN OD copper tube tailpiece.
      c. P-trap: Chrome, 1-1/4 IN or 1-1/2 IN semi-cast with cleanout, with 17 GA x 1-1/4 IN or 17 GA x 1-1/2 IN OD copper tube trap arm.

B. L-2, Lavatory:
   1. Fixture:
      1) Corian Fixture by Others.
   2. Faucet:
      a. Bottom-mounted, 8 IN spread, two 4 IN wristblades 5 IN reach fixed gooseneck.
         1) American Standard Plumbing Heritage 6830.000.
   3. Trim:
      a. Supplies: Chrome, 3/8 IN OD, soft copper tube, loose key stops, escutcheons.
         1) Model.
      b. Grid drain: Chrome, 1-1/4 IN cast brass with 17 GA x 1-1/4 IN OD copper tube tailpiece.
      c. P-trap: Chrome, 1-1/4 IN or 1-1/2 IN semi-cast with cleanout, with 17 GA x 1-1/4 IN or 17 GA x 1-1/2 IN OD copper tube trap arm.

2.7 MIXING VALVES

A. MV-1, exposed valve without cabinet:
   1. Mixing Valve:
      a. Thermostatic, exposed valve:
         1) Symmons 7-200A.
      b. Operating parameters:
         1) Flow control range: 0-6 GPM.
         2) Output temperature range: .
         3) HW supply temperature: .
         4) Supply pressure range: .
   2. Mixing-valve trim:
      a. Volume-control and shut-off valve: In-line, exposed.
         1) Model.
      b. Thermometer: Exposed.
         1) Model.
      c. Atmospheric vacuum breaker: Exposed.
         1) Model.
   3. Provide wall mounting bracket.

2.8 SINKS

A. S-1, Double bowl, single lever control, swing spout:
   1. Fixture:
      a. , Countertop, stainless steel, double-bowl, outlets, centered faucet hole.
         1) Elkay Lustertone LR-3321.
   2. Faucet:
      a. Ledge-mounted, spread escutcheon, single-lever mixing, cast swing spout.
         1) American Standard Plumbing Reliant 4205.000.
   3. Trim:
      a. Supplies: Chrome, , soft copper tube, loose key stops, escutcheons.
      b. For each compartment provide chrome plated brass drain body with chrome plated brass removable basket strainer, neoprene stopper, with chrome plated metal slide post for outlet with copper tube tailpiece.
      c. Continuous waste assembly, Chrome: Cast brass, tee, cast brass nuts, copper tube tailpieces. Coordinate style with disposal and dishwasher when present.
      d. P-trap: Chrome, semi-cast with cleanout, with copper tube trap arm.

B. S-2, Single bowl, single lever control and swingspout:
   1. Fixture:
      a. , Countertop, stainless steel, single-bowl, outlet.
         1) Elkay Lustertone LR-2219.
   2. Faucet:
      a. Ledge-mounted, polished chrome, spread escutcheon, single-lever mixing, cast swing spout.
         1) American Standard Plumbing Reliant 4205.000.
   3. Trim:
      a. Supplies: Chrome, , soft copper tube, loose key stops, escutcheons.
      b. Chrome plated brass grid drain for outlet with copper tube tailpiece.
      c. P-trap: Chrome, semi-cast with cleanout, with copper tube trap arm.

2.9 SINKS, MOP

A. See Article 2.01 MATERIALS – GENERAL

B. MS-1:
   1. Fixture:
      a. One-piece, molded-stone, floor-mounted basin, 3 IN brass or stainless steel drain body, removable dome strainer, vinyl or stainless steel bumper guards on sides not adjacent to wall.
         1) Fiat MSB-2424, .
   2. Faucet:
      a. Wall mounted, combination service-sink fitting, two handles, fixed spout, integral vacuum breaker, hose threads, adjustable wall brace, pail hook, flanged female adjustable arms with integral stops.
         1) Chicago Faucet 897.

2.10 SPARE PARTS

A. Provide two of each type of renewable cartridge, stem, and seat.

2.11 STANDPIPE AND SUPPLY BOXES

A. Standpipe and supply boxes, general (Following general conditions apply unless detailed otherwise in specific descriptions):
   1. Renewable cartridges with integral seats (or renewable seats and stems).
   2. Stainless steel, flush-mounted, water-proof boxes (fully welded), wall flanges.
   3. Materials: Brass, bronze, stainless steel.
   4. Finish on exposed parts:

a. Brass parts: Chrome.
b. Stainless steel parts: Satin.
5. Hose bibb connections:
a. Inlet: 1/2 IN.
b. Outlet: male hose thread.
6. Installable in 3-5/8 IN stud wall.
7. See Architectural details for mounting heights.

B. SB-1, Coffee/Refrigerator supply connection box:
1. Fixture:
a. Provide with single lead free 1/2 IN x 1/4 IN OD outlet compression angle valve.
b. Box shall be 20 GA with 20 GA faceplate. Box and faceplate shall be white powder coated galvanized steel. Faceplate size approximately 7 IN x 7 IN.
c. Guy Gray model number MIB1AB .

2.12 URINALS

A. Urinal fixtures, general (Following general conditions apply unless detailed otherwise in specific descriptions):
1. Fixture material: White vitreous china.
2. Spud material: Brass.
3. Floor-mounted fixtures: Provide bolt caps with retainers for exposed bolts.
4. Nominal flush volume: 1.0 GPF.

B. UR-1, Accessible:
1. Fixture:
a. Wall hung, blowout, top spud, outlet, privacy shields, integral trap.
1) American Standard Plumbing Lynbrook 6601.012.
b. Fixture carrier: Hanger-plate type.
2. Flushometer valve:
a. Chrome finished brass, tall, lever-operated, diaphragm type, integral vacuum breaker, flush connection and spud coupling for top spud, screwdriver back-check angle stop. Match flush volume to fixture requirements.
1) Sloan Royal 180-1.0.

2.13 COMBINATION WATER CLOSET AND LAVATORIES

A. CB-1, combination fixture, on-floor, centered, right, or left toilet, stainless steel:
1. Fixture:
a. Combination toilet/lavatory with integral seat, 12 GA, all welded Type 304 stainless steel, on floor, wall outlet, Ligature-resistant bubbler, 1.6 GPF ULF, single temperature pneumatic metering, ligature-resistant push button, lavatory overflow, lavatory thru-wall extention ‘P’ Trap and cleanout, toilet waste extension, pinned clean-out plug Brass – 4”, waste connection to 4” cast iron, flush valve through wall connector, and wall sleeve.
b. Coordinate toilet location with Architectural plans.
1) Willoughby Industries ECF-1546-ON-BPH-1.6 GPF-PML1-PBH-OV-LW1-TWE-PCB4-TWC-4C- WS-FVT-TG
2) Set timers on lavatory to run for 30 seconds.
c. Flushometer valve:
1) Concealed rough brass, non-hold open pushbutton, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/2 IN back spud, 1 IN wheel handle backcheck angle stop.
a) Sloan Royal 603-1.6

B. CB-2, combination fixture, 45 degree chase wall, on-floor, stainless steel, left or right toilet, modified grab bar and security enclosure plate, accessible:
1. Fixture:

a. ADA compliant, combination toilet/lavatory with integral seat, 12 GA, all welded Type 304 stainless steel, on floor, wall outlet, Ligature-resistant bubbler, 1.6 GPF ULF, single temperature pneumatic metering, ligature-resistant push button, lavatory overflow, lavatory thru-wall extention 'P' Trap and cleanout, toilet waste extension, pinned clean-out plug Brass – 4", waste connection to 4" cast iron, flush valve through wall connector, and wall sleeve, ligature-resistant grab bar & lav. closure plate.
b. Coordinate toilet location with Architectural plans.
   1) Willoughby Industries ECF-1545-ON-BPH-1.6 GPF-PML1-PBH-OV-LW1-TWE-PCB4-TWC-4C- WS-FVT-TG-GBC2
   2) Set timers on lavatory to run for 30 seconds.
c. Flushometer valve:
   1) Included in model number, concealed rough brass, non-hold open pushbutton, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/2 IN back spud, 1 IN wheel handle backcheck angle stop.
      a) Sloan Royal 603-1.6

C. CB-3, combination fixture, rectangular chase wall, on-floor, stainless steel, left or right toilet, modified grab bar and security enclosure plate, accessible:
1. Fixture:
   a. ADA compliant, combination toilet/lavatory with integral seat, 12 GA, all welded Type 304 stainless steel, on floor, wall outlet, Ligature-resistant bubbler, 1.6 GPF ULF, single temperature pneumatic metering, ligature-resistant push button, lavatory overflow, lavatory thru-wall extention 'P' Trap and cleanout, toilet waste extension, pinned clean-out plug Brass – 4", waste connection to 4" cast iron, flush valve through wall connector, wall sleeve, and ligature-resistant grab bar closure plate.
   b. Coordinate toilet location with Architectural plans.
      1) Willoughby Industries ECF-3696-ON-BPH-1.6 GPF-PML1-PBH-OV-LW1-TWE-PCB4-TWC-4C--WS-FVT-TG-GBC
      2) Set timers on lavatory to run for 30 seconds.
   c. Flushometer valve:
      1) Included in model number, concealed rough brass, non-hold open pushbutton, diaphragm type, integral vacuum breaker, flush connection and spud coupling for 1-1/2 IN back spud, 1 IN wheel handle backcheck angle stop.
         a) Sloan Royal 603-1.6

2.14 WATER CLOSETS

A. See Article 2.01 MATERIALS - GENERAL

B. Fixture carriers for wall hung water closets:
1. Carriers consist of drainage fitting, faceplate, foot supports, closet coupling, and associated hardware.
2. Style:
   a. Adjustable:
      1) Capable of being installed to accept accessible and standard-height closets at each carrier by adjusting only the face-plate position.
   b. Floor anchored.
3. Material: Coated cast iron.
4. Weight of construction: Institutional.
5. Extension:
   a. When distance between carrier and closet exceeds manufacturer's recommended distance, provide longer closet coupling, longer fixture studs, and additional foot supports.
6. Provide anchor foot assembly for single carriers.
7. Closet couplings: Cast iron.
8. Hardware:
   a. Provide hardware to assemble carrier and to mount fixture to carrier.

b. Match hardware to fixture requirements.
9. Finish on exposed parts: Chrome unless indicated otherwise in fixture description.

C. Water-closet fixtures, general (Following general conditions apply unless detailed otherwise in specific descriptions):
1. Wall hung closets: Provide fixture carriers.
2. Close-coupled tanks:
a. Provide closet supplies: , chromed, soft copper tube, loose key stop, escutcheon.
b. Provide anti-siphon, brass ballcocks.
c. Flush handles: Chrome.
3. Floor-mounted closets: Provide bolt caps with retainers.
4. Bowls: Elongated.
5. Color: White.
6. Fixture material: Vitreous china.
7. Spud material: Brass.
8. Spud size: 1-1/2 IN.
9. Nominal flush volume: 1.6 GPF.

D. Water-closet Seats, General:
1. Solid plastic.
2. Color: White.
3. Resistant to scratching, stains, chemicals, and cleaning agents.
4. Elongated-bowl style.
5. Stainless steel hinge pins, bolts, and hardware.
6. Check hinges.

E. WC-1, Public wall hung, accessible:
1. Fixture:
a. Wall hung, siphon jet, top spud.
1) American Standard Plumbing Afwall 2257.103.
2. Flushometer valve:
a. Chrome finished brass, 12” tall, lever-operated, diaphragm type, integral vacuum breaker, flush connection and spud coupling for top spud, screwdriver back-check angle stop. Match flush volume to fixture requirements.
1) Sloan Royal 111.
3. Seat:
a. Open-front seat without cover.

F. WC-2, Public wall hung:
1. Fixture:
a. Wall hung, siphon jet, top spud.
1) American Standard Plumbing Afwall 2257.103.
2. Flushometer valve:
a. Chrome finished brass, tall, lever-operated, diaphragm type, integral vacuum breaker, flush connection and spud coupling for top spud, screwdriver back-check angle stop. Match flush volume to fixture requirements.
1) Sloan Royal 111.
3. Seat:
a. Open-front seat without cover.

2.15 UNDERSINK PROTECTIVE COVERS

A. Undersink protective covers, vinyl:
1. Material: Molded closed cell vinyl.
2. Minimum thermal conductivity at mean temperature:
a. $k \leq 1.17$, 75 degF.
3. Attachment method: Reusable snap clips or seamless pre-wrapped.
4. Service: Covers to cleanouts and valves to be removable without damage to clips.

PART 3 - EXECUTION

3.1 GENERAL

A. Install fixtures in first class manner with proper connections to water, drainage and vent systems.

B. Install fixtures at manufacturer's suggested height unless noted otherwise.

C. Install fixtures in accordance with manufacturers' instructions.

D. See that proper grounds are set to form a secure base and an absolutely rigid setting for each fixture.

E. Provide guards and boxing as may be required to protect fixtures against damage from operations of other trades.

F. Where pipes penetrate walls, floors, or ceilings, conceal penetrations with chrome escutcheons or stainless steel plates.

G. Connect exposed traps and supply pipes for fixtures and equipment to rough piping systems at wall, unless otherwise specified.

H. Where plumbing fixtures abut to walls, floors, and countertops, seal with silicone sealant: See Section 07 92 16.

I. On flushometer valves with pipe supports, mount pipe support to wall two-thirds of flush-valve height above fixture spud.

J. Provide undersink protective covers on water supply and waste lines exposed beneath accessible fixtures.

3.2 FIXTURE CARRIER LEVELING

A. Level fixture carriers by shimming floor anchors with steel washers of varying thicknesses.

3.3 ACCESSIBLE FIXTURES

A. Install accessible fixture assemblies to meet requirements of accessibility installing standards

3.4 WATER CLOSET FIXTURE CARRIERS

A. Install each carrier to accept accessible and standard-height water-closet installations so that future change from one height to the other can be accomplished by adjusting only the position of the face plate.

3.5 ADJUST AND CLEAN

A. Valves with adjustable temperature-limit stop: Adjust stop to deliver maximum 110 degF.

B. Remove dirt from fixtures, fittings and traps.

C. Secure escutcheons against wall.

END OF SECTION

DIVISION 23

HEATING, VENTILATING, AND AIR CONDITIONING

SECTION 23 21 13
HYDRONIC PIPING SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Hydronic Piping Systems, as indicated, in accordance with provisions of Contract Documents.

B. Systems and Products Included:
   1. Systems:
      a. Chilled water piping.
      b. Condensate and cooling coil drain piping.
      c. Heating water piping.
      d. Glycol water piping.
      e. Make-up water piping.
      f. Water treatment system piping.
      g. Glycol and glycol feed system.
   2. Products:
      a. Air vents.
      b. Expansion tanks.
      c. Flow switch wells.
      d. Pressure and temperature test stations, combination.
      e. Air Eliminators and Dirt Separators.
      f. Strainers.
      g. Valves.
      h. Water treatment system.

C. Work installed but not furnished:
   1. Automatic valves: Furnished in Section 25 50 00.
      a. Provide fittings and reducers required for installation of automatic valves.
   2. Electronic flow measurement devices: Furnished in Section 25 50 00.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Outside Utilities: Section 20 10 10.

B. Piping standards: Section 20 11 00.

C. Manual valve standards: Section 20 05 23 (for valves with "V" prefix).

1.3 SUBMITTALS

A. Product Data:
   1. Air vents.
   2. Expansion tanks.
   3. Pressure and temperature test stations, combination.
   4. Air Eliminator and Dirt Separators.
   5. Strainers.
   6. Valves, constant flow control.
   7. Valves, manual.
   8. Valves, pressure reducing.
   9. Valves, pressure relief.
   10. Water treatment system.

11. Glycol and glycol feed system.

B. Contract Closeout Information:
   1. Operating and maintenance data for items requiring operational instructions or periodic maintenance such as: air vents, constant flow control valves, pressure relief valves, triple duty valves, water flow measurement devices, water treatment system, glycol feed systems, etc.
   2. Field test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. High Capacity air vents, automatic:
   1. Base:
   2. Optional:
      a. Metraflex.
      b. Armstrong International.
      c. Hoffman Specialty.
      d. Thrush.

B. Low capacity air vents, automatic:
   1. Base:
   2. Optional:
      a. Armstrong International.
      b. Hoffman Air & Filtration Systems.
      c. Bell & Gossett, ITT.
      d. Taco.
      e. Thrush.

C. Air vents, manual:
   1. Base:
   2. Optional:
      a. Crane Valves.
      b. Jenkins.
      c. Johnston.
      d. OIC.
      e. Powell.
      f. Stockham Valves & Fittings.

D. Expansion tanks:
   1. Base:
   2. Optional:
      a. Thrush.
      b. Armstrong Pumps.
      c. Bell & Gossett, ITT.
      d. Taco.

E. Pressure/temperature test stations, combination (P/T plug).
   1. Base:
   2. Optional:
      a. Peterson Equipment Company (Pete's plug).
      b. Sisco P/T Plugs & Flex Connectors.
      c. Super Seal.
      d. Fairfax.

F. Air Eliminator and Dirt Separators:
   1. Base:

a. Spirotherm.
2. Optional:
a. Armstrong International.
b. Bell & Gossett, ITT.
c. Taco.

G. Strainers, air separator/strainers:
1. Base:
2. Optional:
a. Thrush.
b. Armstrong Machine Works.
c. Bell & Gossett, ITT.
d. Taco.

H. Strainers, in-line wye strainer and valve combination:
1. Base:
2. Optional:
a. Flow Design Inc.
b. Griswold Controls.
c. Nexus Valve.

I. Strainers, single-basket and tee:
1. Base:
2. Optional:
a. Armstrong Machine Works.
b. Hoffman Specialty, ITT.
c. Keckley, OC.
d. Metraflex.
e. Mueller Steam Specialty.
f. Spence Engineering.
g. Spirax Sarco.
h. Tate.
i. Tate.
j. Victaulic of America.

J. Valves, constant flow control:
1. Base:
2. Optional:
a. Flow Design Inc..
b. Griswold Controls.
c. Nexus Valve.

K. Valves, pressure reducing (water and glycol):
1. Base:
2. Optional:
a. Watts Control Valves.
b. Armstrong Pumps.
c. Conbraco.
d. Bell & Gossett, ITT.
e. Taco.
f. Thrush.

L. Valves, pressure relief (water and glycol):
1. Base:
2. Optional:
a. Farris.
b. Armstrong Pumps.
c. Bell & Gossett, ITT.

d. Taco.
e. Teledyne Farris Engineering.
f. Thrush.

M. Water-treatment-system cleaning chemicals:
1. Base:
a. Oakite Products.
2. Optional:
a. Mitco.
b. Diversey Water Technologies.

N. Water-treatment-system chemical pot feeders:
1. Base:
a. Wessels
2. Optional:
a. Mitco.
b. Calgon-Vestal.
c. Diversey Water Technologies.
d. Nalco.

O. Glycol:
1. Base:
a. The Dow Chemical Company.
2. Optional:
a. Interstate Chemical Company.

P. Glycol Feed System:
1. Base
a. Neptune.
2. Optional
a. Wessels
b. Wingert.

Q. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Pipe And Fittings
1. Pipe and fittings - General:
a. The following are not permitted:
1) Plain end, pressure fit type fittings.
2) Hole cut mechanical tee or saddle fittings.
2. Fittings: galvanized where galvanized piping is used.
3. Chilled water piping, above grade:
a. Copper, type L, with soldered joints, and wrought copper or cast brass fitting.
b. Black steel.
1) 2 IN and smaller: Threaded joints, with cast iron or malleable iron threaded fittings.
2) 2-1/2 IN and larger: Welded joints.
c. Inside fan plenums (and piping from coil connections to piping headers inside and outside of plenums):
1) Copper, type L, with soldered joints, and wrought copper or cast brass fittings.
4. Condensate and cooling-coil-drain piping:
a. Copper, type M or L, and soldered joints.
5. Glycol-water piping:
a. Black steel, with welded joints.
1) For 2-1/2 IN and larger: Use forged butt welding fittings.
2) For 2 IN and less: Use socket welding fittings, 2000 or 3000 PSI class.
3) Threaded pipes and nipples may be used only at valve and equipment connections.

4) Weld-o-let or thread-o-let type of fittings may be used in lieu or tees for branch connections, provided main is one size larger than takeoff.
   a) Couplings or half couplings are not acceptable except for non-flow connections such as thermometers or gauges.

6. Heating water piping, above grade:
   a. Copper, type L, with soldered joints, and wrought copper or cast brass fittings.
   b. Black steel, with welded joints.
      1) For 2-1/2 IN and larger: Use butt welding fittings.
      2) For 2 IN and less: Use socket welding fittings, 2000 PSI class, malleable or cast iron threaded fittings.
      3) Weld-o-let or thread-o-let type fittings may be used in lieu of tees for branch connections, provided main is one size larger than takeoff. Couplings or half couplings are not acceptable except for non-flow connections such as thermometers or gauges.
7. Make-up water piping:
   a. Same as system served.
8. Water treatment system piping:
   a. Same as system served.

B. AIR VENTS
1. High Capacity, automatic:
   a. 300 PSI rated test pressure, minimum.
   b. Maximum working pressure: 150 PSIG.
   c. Maximum temperature: 212 degF.
   d. Body and cover material: Cast iron, ASTM-A126, Class B.
   e. Seat material: Stainless steel-T303, ASTM-A276 or Viton.
   f. Float and float arm material: Stainless steel-T304, ASTM-A240.
2. Low Capacity, automatic:
   a. 150 PSI rated, minimum.
   b. Maximum working pressure: 100 PSIG.
   c. Maximum temperature: 212 degF.
   d. Cast bronze, chrome plated, body with renewable valve and seat.
   e. Synthetic rubber disc.
3. Air vents, manual:
   a. Vent valves: 1/4 IN 125 PSI globe angle valve with XH nipple connecting to pipe.

C. EXPANSION TANKS
1. Tanks, expansion (air-elimination system):
   a. Pre-pressurized diaphragm type.
   b. Size: As scheduled.
   c. Rated pressure: 125 PSIG.
   d. Rated operating temperature: 240 degF, minimum.
   e. Precharge pressure: Same as scheduled minimum operating pressure.
   f. Bladder: Heavy duty butyl, removable for inspection.
   g. ASME constructed and stamped.

D. Flow Switch Wells
1. Flow switch wells:
   a. Install 1 IN thread-o-let for flow switch installation.
   b. Provide 1 IN nipple and cap.

E. Pressure And Temperature Test Stations, Combination
1. Pressure/temperature test station, combination:
   a. Station to receive either a 1/8 IN OD temperature or pressure probe.
   b. Fitting: Solid brass, 1/4 IN NPT, with 2 valve cores of neoprene (maximum 200 degF at 500 PSI) or Nordel (maximum 275 degF at 500 PSI).

c. Provide extension at locations with pipe insulation. Extension length shall match or exceed insulation thickness.
d. Provide with color coded and marked cap with gasket, rated at 1000 PSI at 140 degF.

2. Pressure and temperature test kit:
a. Range: 0-100 PSI, 0-230 FT WG.
b. 1/8 IN OD probe and 5 IN stem pocket testing thermometers.
1) Provide 1 for chilled water: 25-125 degF.
2) Provide 1 50-500 degF for hot water.
c. No. 500 gauge adapter with 1/8 IN OD probe.
d. Protective carrying case.

F. Air eliminators and dirt separators
1. Air eliminators and dirt separators:
a. Coalescing type air eliminator and dirt separator.
b. Shell: Fabricated Steel.
c. Seals: Viton.
d. Removable stainless steel or copper wound air/dirt collection medium.
e. An integral full port float actuated brass venting mechanism shall be installed at the top of the venting chamber.
f. Design pressure: 150 PSIG.
g. NPT tappings for vent and blowdown connections.
h. Air Removal Efficiency: 100% free and entrained air and 99.6% dissolved air.
i. Dirt Removal Efficiency: 80% of all particles 30 microns and larger within 100 passes.
j. Removable lower head to facilitate removal of internal assembly for inspection

G. Strainers
1. Strainers, air separator/strainers:
a. ASME code construction.
b. Removable stainless steel air collector tube.
c. NPT tappings for vent and blowdown connections.
d. Stainless steel strainer with 3/16 IN diameter perforations.
1) Free area: Not less than 5 times cross sectional area of connecting pipe.
e. Working pressure: 125 PSIG at 350 degF.

2. Strainers, in-line wye strainer and valve combination:
a. One piece configuration consisting of O-ring union, P/T plug, blow down and ball valve with handle.
b. Strainer valves 1-1/4 IN and smaller: Limit passage of particles larger than 500 microns.
c. Strainer valves 1-1/2 IN and larger: Limit passage of particles 1000 microns and larger.
d. Bronze body construction with threaded or sweat connections.
1) Internal parts: Brass and stainless steel.
2) Ball valve:
a) Ball and stem: 316 stainless steel.
b) Port size: standard.
c) Blowout proof stems.
d) Reinforced Teflon (PTFE) seats.
e) Teflon (PTFE) seals.
f) Adjustable packing.
g) Extended necks and stems that isolate moving valve parts from insulation.
e. Provide valves with unions to allow field exchange of internal components without removing valve body from pipeline.
f. Provide metal ID taps permanently marked to show direction of flow, strainer mesh and model number.

3. Strainers, single-basket type.
a. Screwed or flanged.
b. Body: Cast iron, flanged ends, bolted access cover.

c. Coating: Rust inhibiting.
d. Working pressure, non shock: 150 PSIG.
e. Screens: Bronze, monel or stainless steel.
1) 2 IN and less: 3/64 IN perforations.
2) 2-1/2 IN and larger: 1/8 IN perforations.

4. Strainers, suction diffusers:
a. Angle cast iron body type with inlet vanes and combination diffuser-strainer-orifice cylinder.
b. Provide with disposable 16 mesh strainer for system start-up.
c. Orifice cylinder with 3/16 IN diameter openings.
1) Designed to withstand pressure differential equal to pump shutoff head (maximum 175 PSI).
2) Free area equal to 5 times cross-section area of pump suction opening.
d. Vane length: Not less than 2-1/2 times pump suction opening.
1) Provide with adjustable support foot to carry weight of suction piping.

5. Strainer, tee-pattern type.
a. Grooved ends.
b. Body: One-piece ductile iron casting conforming to ASTM-A536 or malleable iron conforming to ASTM-A47.
c. Coating: Rust inhibiting.
d. Working pressure rating: 300 PSI.
e. Basket screen: 304 stainless steel 0.041 IN wire in a woven No.6 mesh wire screen with 0.126 IN opening.
f. Vertical down flow or horizontal flow.
g. Cleaning access through blank end cap.

6. Strainers, wye:
a. See Section 20 05 19, Piping Specialties.

H. Valves
1. Constant flow control valves:
a. Factory calibrated, direct acting, automatic pressure compensating.
b. Control flow rates within 4 percent of flow rating over operating pressure differential range.
1) Set flow rating to match the maximum flow required by device served.
c. Pressure differential range:
1) 2-32 PSID.
d. Threaded-brass or copper-sweat body with stainless-steel internal parts.
e. Provide a metal identification tag with chain for each installed valve.
1) Identify valve model number, rated GPM, direction of flow, and differential pressure range.
f. Provide with integral unions to allow field exchange of internal components without removing valve body from pipeline.
g. Provide as indicated.

2. Manual valves:
a. Angle valves:
1) 2 IN and smaller: V-17.
2) 2-1/2 IN and larger: V-18.
b. Balancing valves:
1) 2 IN and smaller: V-64.
2) 2-1/2 IN to 12 IN: V-65.
3) 8 IN and larger:
a) Plug valve: V-37 with memory stop.
b) Provide venturi waterflow measuring device.
4) Ball type balancing valves/circuit setters shall not be used.
c. Isolation valves (Ball valves):
1) 2 IN and smaller: V-13 or V-14.

d. Isolation valves for chilled water (Butterfly valves):
   1) 2 IN and smaller: not used.
   2) 2-1/2 IN and larger: V-63.Isolation valves for hot and glycol water (Butterfly valves):
   1) 2 IN and smaller: not used.
   2) 2-1/2 IN and larger: V-34 or V-35.
f. Check valves, pump discharge:
   1) 2 IN and smaller: V-25 or V-26.
   2) 2-1/2 IN and larger: V-28, V-29, or V-30.
g. Check valves, other:
   1) 2 IN and smaller: V-25.
   2) 2-1/2 IN and larger: V-28 or V-29.
h. Globe valves:
   1) 2 IN and smaller: V-6 or V-7.
   2) 2-1/2 IN and larger: V-8.
i. Plug valves:
   1) 2 IN and smaller: V-36.
   2) 2-1/2 IN and larger: V-37.

3. Pressure reducing valves:
   a. Water type, diaphragm operated with low inlet pressure check valve and built-in strainer.
   b. Construction:
      1) Body: Brass.
      2) Diaphragm: EPT.
      3) Check valve: Rubber.
      4) Seat: Brass.
      5) Stem: Brass with Buna N insert.
      6) Strainer: Brass.
   c. Maximum working pressure: 100 PSIG.
   d. Adjustable pressure range: 25-60 PSIG.
4. Pressure relief valves, water:
   a. ASME-approved, tight-shutoff, self-closing.
   b. 2-1/2 IN and less: Screwed.
   c. 3 IN and larger: Flanged.
   d. Ten percent over pressure.
   e. Test lever.
   f. Capacity: Same BTUH as equipment served. See schedules.
   g. Relief setting: 125 PSIG unless indicated otherwise**.**

2.3 WATER TREATMENT SYSTEM

A. Water-treatment-system cleaning chemicals:
   1. Alkaline:
      a. Oakite 62, 162, 24, 77.
   2. Acid:
      a. Oakite 32.

B. Water-treatment-system chemical feeders:
   1. Pot type feeders constructed for operating pressure of 150 PSI.
   2. Capacity of feeders: 3 GAL minimum.

2.4 GYLCOL

A. Industrially inhibited propylene glycol:
   1. Operating temperature range: –50 deg F to 325 deg F .
   2. Corrosion inhibitors: Suited for systems containing steel and copper components.
   3. Color: Bright yellow.

4. Manufacturer: Dowfrost HD by the Dow Chemical Company.
5. Piping system to be filled:
   a. P.G. Hot water

B. Glycol Feed System:
1. General: Provide packaged pre-piped, prewired feed system for each system containing glycol to automatically maintain the pressure in the system by adding glycol solution to make up for losses which occur due to leakage.
   a. Tank: 50 gallon polyethylene tank mounted in steel frame.
   b. Pump: Bronze rotary gear pump rated at 3 GPM and 100 psig.
   c. Float Switch: Include low level float switch to shut off pump and indicate alarm.
   d. Control Panel:
      1) Hand-off-auto switch.
      2) Pump “on” indicator light.
      3) “Low” tank level indicator light and dry contacts for remote alarm.
      4) Nema 4X enclosure.
   e. Suction assembly :
      1) PVC tubing and fittings.
      2) PVC ball valve.
      3) Cast iron wye strainer
   f. Discharge assembly:
      1) Schedule 80 PVC pipe and fittings.
      2) PVC ball valve.
      3) PVC check valve.
      4) Brass relief valve with return to tank.
   g. Manufacturer: Neptune G-50-1-RC-LP.

2.5 VIBRATION ISOLATION

A. Vibration Isolation: Section 20 05 50.

PART 3 - EXECUTION

3.1 GENERAL

A. Install in accordance with Section 20 11 00 and Section 20 05 00.

B. Connect equipment.

3.2 PIPE AND FITTINGS

A. Threaded joints in glycol-water piping:
1. Remove pipe cutting oil from threads by scrubbing in Portland cement.
2. Coat dry threads with Rectorseal No. 7 or "Permatex High Temperature thread sealant product No. 59235 or No. 59225" pipe compound prior to assembly.

B. Do not insulate or conceal piping until testing is completed.

3.3 AIR VENTS

A. Air vents, automatic:
1. Provide shut off valve ahead of vent.
2. Provide copper relief line from valve to drain or drip pan.
3. Provide at locations indicated on equipment and piping schematic drawings.

B. Air vents, manual:
1. Vents shall prevent air binding in systems.
2. Vent valves:
   a. Provide at trapped high points of closed cooling and heating piping systems.

b. Provide at coil headers in air handling units unless an automatic air vent is indicated at that location on equipment or piping schematic drawings.

3. Coin operated vents:
   a. May be used in lieu of vent valves at coil headers for terminal units with piping connections 1-1/4 IN and smaller.

3.4 FLOW SWITCH WELLS

A. Provide flow switch wells at following locations:
   1. Condenser water supply line to each chiller.
   2. Chilled water return line to each chiller.

3.5 PRESSURE AND TEMPERATURE TEST STATIONS, COMBINATION

A. Provide at locations indicated on equipment and piping schematic drawings.

3.6 AIR ELIMINATORS AND DIRT SEPARATORS

A. Provide at locations indicated on equipment and piping schematic drawings.

3.7 STRAINERS

A. Provide full line size strainers ahead of control valves (motor operated), regulating valves, pumps, and as indicated.

B. Provide strainer types as indicated:
   1. Condenser water: Single-basket or tee type.
   2. Chilled water: Single-basket, tee, or wye type.
   3. Heating water: Single-basket, tee, or wye type.

C. Connections to suit piping.

D. Provide blow-down valves:
   1. Strainers 6 IN and larger: 1-1/2 IN blow-down valve.
      a. Pipe blow down to drain.
   2. Strainers 2 to 5 IN: 1 IN blow-down valve with 3/4 IN hose end connection.
   3. Strainers 1-1/2 IN and smaller: 1/2 IN blow-down valve with 3/4 IN hose end connection.

3.8 VALVES

A. Heating and cooling pipe risers:
   1. Provide isolation valves at main feed points to risers.
   2. Provide isolation valves at branch take-offs from risers.

B. Install pressure relief valves on heat exchangers' piping between exchanger and isolation valves.

C. Provide drain piping at pressure relief valves and valves with test levers.
   1. Extend piping to within 6 IN of floor.

D. Provide system drains: See Section 20 05 19.

E. Provide 3-valve manifold for each differential pressure sensor.
   1. Coordinate locations and quantities of sensors with Controls Contractor.

3.9 WATER TREATMENT SYSTEM

A. Mount chemical feeder across balance valve on pump discharge of systems.
   1. Heating water system.
   2. Glycol Hot Water System

3.10 CONDENSATE DRAINS

A. Pipe condensate drains for all equipment (i.e. air handling units, fan coil units, kitchen condensing units, etc.) and route to nearest floor drain, mop sink, etc. Coordinate final location with architect.

3.11 VIBRATION ISOLATION

A. Vibration Isolation: Section 20 05 50.

3.12 TESTING

A. Test heating and cooling piping upon completion of a section or of entire system.
   1. Test hydrostatically to pressure not less than 50 percent in excess of maximum pressure to which pipe will ordinarily be subjected, but in no case less than 150 PSI.
   2. Repair or replace leaks or defective pipe disclosed by tests.
   3. Repeat tests until piping indicates tight.

3.13 CLEANING OF CHILLED AND HEATING WATER SYSTEMS

A. Do not valve in or operate system pumps until after system has been cleaned.

B. At system completion, make temporary connection to domestic water system, and flush system until clear water is visible from drain connection.
   1. Drain system after flushing.

C. At project completion, clean systems:
   1. Thoroughly flush system with a recommended hot solution (160-180 degF) of alkaline cleaning chemical to remove oil and grease that may be present.
      a. Thorough flushing includes eliminating air from system.
      b. Drain systems, and rinse completely with clean water.
      c. Measure and record volume of each system for purpose of chemical treatment.
   2. Add water and acid solution, and circulate through systems as recommended by manufacturer to remove rust and scale.
      a. Circulate solution through systems at a minimum velocity of 10 FPS.
      b. Drain systems, and rinse completely with clean water.
         1) Rinse system at a minimum velocity of 10 FPS.
   3. Check drain water for pH level.
   4. If drain water is acidic, neutralize system by thoroughly reflushing with alkaline-type material as indicated above.

D. After cleaning is complete, and just before start-up, clean strainers.

3.14 START-UP

A. After cleaning is complete, and water pH is acceptable to manufacturer of water treatment chemicals, add manufacturer-recommended amount of chemicals to systems.

B. For glycol-water systems, add sufficient propylene glycol to provide 30 percent by volume of glycol to water mixture. Utilize distilled water in accordance with manufacturer's instructions.

C. Provide monthly testing for the first six months after start-up to verify that the correct chemical concentrations are present in each system.

END OF SECTION

SECTION 23 21 23
HVAC PUMPS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for HVAC Pumps, as indicated, in accordance with provisions of Contract Documents.

B. Types Included:
   1. In-line pumps.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Standards:
   1. Hydraulic Institute Standards: HI1983, 14TH Edition.
   2. Hydraulic Institute Engineering Data Handbook: HI979, First Edition.

1.3 SUBMITTALS

A. Product Data:
   1. Pumps:
      a. Include curves.

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Letter stating extra material has been delivered.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flexible pump couplings:
   1. Base:
      a. Dodge Regupol; "Para-flex".
      b. Wood's "Sure-flex".

B. In-line pumps:
   1. Base:
   2. Optional:
      a. Allis-Chalmers, ITT.
      b. Aurora.
      c. Buffalo Forge.
      d. Goulds Pumps.
      e. Bell & Gossett, ITT.
      f. Peerless Pump.
      g. Taco.
      h. Weil Pump.
      i. Ingersoll Dresser Pumps.

C. Pumps and drives by same manufacturer.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. In-Line Pumps
   1. In-line pumps, heating and cooling water: Centrifugal, close-coupled, single stage, bronze fitted, vertical mount.
      a. Capacity: As scheduled.
      b. Capable of being serviced without disturbing piping connections.
      c. Pump body: Cast iron with 125 PSI ANSI drilled flanges.
         1) Rated working pressure: 175 PSI.
         2) Provide with gauge ports.
      d. Impeller: Non-ferrous material, enclosed type.
         1) Hydraulically and dynamically balanced.
         2) Keyed to shaft and secured by locking capscrew.
      e. Provide internally-flushed mechanical seal with ceramic seal seat.
      f. Non-ferrous shaft sleeve to cover wetted area under seal.
      g. Motor: Open drip-proof enclosure with regreaseable ball bearings.

2.3 EXTRA MATERIALS

A. Provide one extra mechanical pump seal with gaskets for each double suction pump.

2.4 VIBRATION ISOLATION

A. Vibration Isolation: Section 20 05 50.

PART 3 - EXECUTION

3.1 GENERAL

A. Install pumps according to manufacturer's recommendations and as specified.

3.2 BASE MOUNTED PUMP INSTALLATION

A. Set floor mounted horizontal pump on concrete base.

B. Level and bolt down.

C. Fill entire base with non-shrinking grout.

D. After pump base grouting is complete, align pump and each driver accurately to provide out of alignment of not over 0.004 IN in both axial and angular planes.
   1. After alignment, pin pump and motor to base with taper pins using minimum of 3 pins each.

E. Connect to piping system as indicated.

3.3 VIBRATION ISOLATION

A. Vibration Isolation: Section 20 05 50.

END OF SECTION

SECTION 23 22 00
STEAM DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Steam Distribution System, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Steam and steam condensate valves.
   2. Specialties.
   3. Pipe and fittings.
   4. Condensate pumps and receiver.

C. Work installed but not furnished:
   1. Automatic valves: Furnished in Section 25 50 00.
      a. Provide necessary fittings and reducers.

D. Completely coordinate with work of other trades

1.2 QUALITY ASSURANCE

A. Manual valve standards: Section 20 05 23 (for valves labeled "V-__").

B. Outside Utilities: Section 20 10 10.

C. Piping standards: Section 20 11 00.

1.3 SUBMITTALS

A. Product Data:
   1. Steam valves.
   2. Steam condensate return valves.
   3. Traps.
   4. Condensate pumps/receivers.

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Steam traps :
   1. Base:
      a. Armstrong International.
   2. Optional:
      a. Illinois.
      b. Spirax Sarco.

B. Condensate pumps/receivers (Electric):
   1. Base:
      a. Skidmore.
   2. Optional:
      a. Dunham-Bush.
      b. Weinman.
      c. Armstrong.

d. Nash Engineering Co.
e. Roth.
f. Domestic Pump ITT.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Steam Valves To 100 Psig
1. Isolation valves (high performance butterfly valves), LPS and MPS.
   a. 2-1/2 IN and larger: V-63.
2. Globe valves, LPS and MPS:
   a. 2 IN and smaller: V-7.
   b. 2-1/2 IN and larger: V-8.
3. Angle valves, LPS and MPS:
   a. 2 IN and smaller: V-17.
   b. 2-1/2 IN and larger: V-18.
4. Check valves, vacuum breaker, LPS and MPS (2 IN and smaller): V-23.
5. Check valves, other, LPS and MPS:
   a. 1-1/2 IN and smaller: V-25.
   b. 2 IN and larger: V-22 or V-28.

B. Steam Condensate Return Valves
1. Isolation valves (ball valves):
   a. 2 IN and smaller: V-13 or V-14.
2. Globe valves:
   a. 2 IN and smaller: V-6 or V-7.
   b. 2-1/2 IN and larger: V-8.
3. Angle valves:
   a. 2 IN and smaller: V-17.
   b. 2-1/2 IN and larger: V-18.
4. Butterfly valves:
   a. 2-1/2 IN and larger: V-33.
5. Plug valves:
   a. 2 IN and smaller: V-36.
   b. 2-1/2 IN and larger: V-37.
6. Pump discharge check valves:
   a. 2 IN and smaller: V-25 or V-26.
   b. 2-1/2 IN and larger: V-28, V-29, or V-30.
7. Other check valves:
   a. 2 IN and smaller: V-25.
   b. 2-1/2 IN and larger: V-28 or V-29.

C. Specialties
1. Steam traps - general:
   a. Sizes: As indicated, minimum; increase size if required to meet capacity requirements.
   b. Provide dirt pocket and wye strainer full size of trap opening.
   c. Provide shut-off valve and union on each inlet.
   d. Provide check and gate valve in discharge, at each lift leg.
2. Steam traps, low pressure (15 PSIG and less):
   3. Equipment traps: Use F & T type rated at 15 PSI working pressure. Each trap shall be sized using 1/2 PSI pressure drop and 2 times scheduled flow rate of equipment. Where two traps are shown on a single piece of equipment (e.g. heat exchanger), each trap shall be sized for 100% redundancy.

Trap Size	Capacity
DN20	250 kg/h
DN25	320 kg/h
DN32	430 kg/h
DN40	955 kg/h
DN50	1820 kg/h

Trap Size	Capacity
3/4 IN	400 lb/hr
1 IN	700 lb/hr
1-1/4 IN	900 lb/hr
1-1/2 IN	1700 lb/hr
2 IN	4000 lb/hr

4. End of main traps: Use inverted bucket type. Trap sizes shall be as indicated on plans. If size is not indicated, the minimum trap size shall be ¾ IN . The minimum capacities for each size of trap shall be as follows (based on 2 PSI 14 kPa differential):

Trap Size	Orifice Size	Capacity
DN20	DN 5	150 kg/h
DN20	DN6	350 kg/h
DN25	DN10	800 kg/h
DN32	DN13	1200 kg/h
DN40	DN14	1800 kg/h

Trap Size	Orifice Size	Capacity
3/4 IN	3/16 IN	350 lb/hr
3/4 IN	¼ IN	800 lb/hr
1 IN	3/8 IN	1600 lb/hr
1-1/4 IN	½ IN	2600 lb/hr
1-1/2 IN	9/16 IN	4000 lb/hr

5. Steam traps, medium and high pressure (over 15 PSIG):
   a. Equipment traps: Use F & T type.
   b. Equipment traps (16-30 PSIG): Sized using 2 PSI pressure drop and 2 times scheduled flow rate of the equipment.
   c. Equipment traps (over 30 PSIG): Sized using 1/2 of the maximum pressure differential across the trap and 3 times scheduled flow rate of the equipment.
   d. End of main traps: Use bucket type. Trap size: as indicated on plans. If size is not indicated, the minimum trap size shall be 3/4 IN . The minimum capacities for each size of trap shall be as follows (based on 2 PSI differential):

Trap Size	Capacity
DN20	520 kg/h
DN25	1045 kg/h
DN32	1680 kg/h
DN40	2455 kg/h
DN50	4865 kg/h

Trap Size	Capacity
3/4 IN	1150 lb/hr
1 IN	2300 lb/hr
1-1/4 IN	3700 lb/hr
1-1/2 IN	5400 lb/hr
2 IN	10700 lb/hr

6. Bucket traps: straight through pattern to permit maximum headroom under return piping.
   a. Provide check valve on required lift legs.
   b. Basis of Design: Armstrong Series 200 and 800.
   c. Rated for 250 PSIG operating pressure.
7. Float and thermostatic traps (F & T):
   a. Basis of Design (15 to 30 psig): Armstrong Series B.
   b. Basis of Design (Above 30 psig): Armstrong Series A.
8. Steam traps on equipment: Provide traps and cooling legs, 18 IN deep minimum:
   a. Connect trap line to cooling leg 6 IN from bottom.
   b. Provide cap.
   c. Install trap above floor (elevate equipment if necessary).
   d. Where equipment is mounted close to structural floor and it is not possible to elevate equipment, install trap below floor; provide sleeve in floor.
9. Strainers: See Section 20 05 19.
10. Supports, sleeves and seals: See Section 20 05 29.
11. Flashings: See Section 20 05 00.
12. Thermometers: See Section 20 05 19.
13. Pressure gauges: See Section 20 05 19.

D. Pipe And Fittings
1. Steam and steam vent piping: Black steel (Schedule 40), seamless piping.
   a. 2-1/2 IN and larger: Use welded joints, with steel butt welding fittings.
   b. 2 IN and smaller: Use threaded joints, with cast iron threaded fittings, or welded joints with socket welding (3000 PSI) fittings.
2. Steam condensate and pumped condensate piping above grade: Black steel (Schedule-80), seamless piping.
   a. 2-1/2 IN and larger: Use welded joints, with butt welding fittings.
   b. 2 IN and smaller: Use threaded joints, with cast iron threaded fittings, or welded joints with socket welding (3000 PSI) fittings.
3. Relief vent pipe and fittings: Same as steam piping.
4. Steam and steam condensate fittings:
   a. Weld-o-let or thread-o-let type fittings are optional for branch connections except on pump suction lines.
   b. Weld-o-let or thread-o-let type fittings are optional for branch connections provided main is one size larger than takeoff.
   c. Unions 2 IN and smaller: Ground joint, malleable iron, pattern, 175 PSI SWP type.

E. Condensate Pumps/Receiver (Electric)
1. Condensate pumps/receiver, above ground: Duplex, factory assembled, with pumps, receiver, and controls for above floor mounting.
   a. Capacity: As scheduled.
   b. Pump: Vertical submerged centrifugal or turbine type suitable for operation with 210 degF condensate.
      1) Bronze impeller, renewable liners and stainless steel shafts.
      2) Flanged mounted on receiver and close coupled to vertical motor.
   c. Motor: See Section 20 05 00.
      1) Non-overloading at working pressure up to design pressure.
      2) Provide magnetic starters for 3-phase motors.

d. Float switches: Heavy duty 2-pole with seamless copper float and stainless steel rod.
e. Receiver: Cast iron, with inlet, vent and overflow connections.
f. Controls: Contained in a unit mounted NEMA II control cabinet with hinged door.
   1) Two combination magnetic starters with circuit breakers and cover interlock.
   2) Manual sequence control switches.
   3) Manual select lead pump.
   4) Each pump control circuit to be independent of the other.
   5) Alternator: Provide simultaneous operation under peak load conditions; and operate second pump automatically, should active pump or its controls fail.
   6) Provide control circuit transformer for each circuit.
g. Provide inlet strainer with vertical self-cleaning bronze screen and large dirt pocket mounted on receiver.

PART 3 - EXECUTION

3.1 PIPING - GENERAL

A. Install in accordance with Section 20 11 00 and Section 20 05 00.

B. Provide drain piping from safety valves and valves that have test levers to floor drain.

3.2 STRAINERS

A. Provide full line size wye strainers ahead of steam control valves (motor operated), steam traps, regulating valves, pumps, and where indicated.
   1. See Piping Specialties: Section 20 05 19.

3.3 TESTING

A. Allow no piping to be insulated, concealed, or furred-in until it has been tested to satisfaction of Engineer.

B. Upon completion of a section or of entire piping systems, hydrostatically test to pressure not less than 50 percent in excess of maximum pressure to which pipe will ordinarily be subjected, but in no case less than 150 PSI .
   1. Remove traps during tests and valve off or bypass coils, pumps and equipment, etc.

C. Repair leaks and replace defective pipe disclosed by tests and repeat tests until piping is air tight.

3.4 CLEANING

A. Cleaning of steam supply piping: Before steam supply system is placed in service either for temporary or permanent use, clean and flush as follows:
   1. For temporary use where additional piping will be added to system as construction proceeds, flush piping by "blowing down" with steam.
   2. At completion of project after piping is complete, flush piping by "blowing down" with steam until visual inspection indicates system cleaned. During "blow down" period: Waste condensate to sewer.
   3. After "blow down" period is complete, thoroughly clean strainers and traps.

B. Cleaning of condensate return piping: Before steam condensate return system is placed in service either for temporary or permanent use, clean and flush as follows:
   1. For temporary use where additional piping will be added to system as construction proceeds, and before strainers, traps, equipment, etc., are installed, flush piping by "blowing down" with steam.
   2. At completion of project after piping is complete, and steam supply mains are "Blown Down", flush steam condensate return piping by "blowing down" with steam until visual inspection indicates system cleaned.
   3. Prior to "blowing down" system remove strainers and traps from system and bypass equipment connected to system.
   4. During "blow down" period: Waste condensate to sewer or atmosphere outside building.

5. After "blow down" period, clean strainers and traps and reinstall in piping system. Reconnect equipment previously bypassed.

END OF SECTION

SECTION 23 31 13
AIR DISTRIBUTION SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Air Distribution System, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
1. High and low pressure ductwork, fittings and accessories.
2. Acoustical duct liner.
3. Dampers.
4. Fire and smoke dampers.
5. Diffusers, registers and grilles.
6. Sound attenuators.
7. Insulated plenum walls.
8. Air blenders.
9. Louver blank-off plates.
10. Duct access doors.
11. Combination louvers.
    a. Architectural louvers: See Section 08 91 00.
12. Pressure relief doors.
13. Control dampers less actuators.
    a. Actuators for control dampers: See Section 25 50 00.

C. Definitions:
1. Low and high pressure ductwork: See Article 2.2 of this section.
2. Gage:
    a. Steel sheet and wire: U S Standard Gage.
    b. Aluminum sheet: Browne & Sharpe Gage.
    c. Steel wire: Washburn and Moen Gage.
3. Concealed insulated surfaces: Piping, ductwork and equipment in walls, partitions, floors, pipe chases, pipe shafts, duct shafts and above suspended ceilings.
4. Exposed insulated surfaces: Piping, ductwork and equipment located in mechanical rooms, tunnels and rooms without suspended ceilings.

D. Location of diffusers, registers and grilles are indicated on Architectural reflected ceiling plans.

E. Control dampers installed in air handling units: delivered to air handling unit manufacturer and factory mounted in unit. Actuators shall be field mounted under Section 25 50 00.

F. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Design and installation standards:
1. ASHRAE Handbook - HVAC Systems and Equipment: Current chapter on duct construction.
2. ADC Standard 1062: GRD-84, Test Code for Grilles, Registers and Diffusers.
3. ADC Test Code FD 72-R1, Flexible Air Duct Test Code.
4. AMCA Standard 210, Test Code for Air Moving Devices.
5. ASHRAE Standard 70-72, Method of Testing for Rating the air flow performance of outlets and inlets.

6. NFPA-90A, Standard for the Installation of Air Conditioning and Ventilating Systems, current edition.
7. NFPA-96, Standard for the Installation of Equipment for the Removal of Smoke and Grease-Laden Vapors from Commercial Cooking Equipment, current edition.
8. SMACNA HVAC Duct Construction Standard - Metal and Flexible, Current Edition.
9. SMACNA Duct Cleanliness for New Construction, Current Edition.
10. ASTM E84: Standard Test Method for Surface Burning Characteristics of Building Materials.
11. ASTM A653/A653M: Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy Coated (Galvanealed) by the Hot-Dip Process.
12. ASTM A109: Standard Specification for Steel, Strip Carbon (0.25 Maximum Percent), Cold-Rolled.
13. ASTM B23: Standard Specification for White Metal Bearing Alloys (Known Commercially as Babbit Metal).
14. ASTM E96: Standard Test Methods for Water Vapor Transmission of Materials.
15. UL 181A: Closure Systems for Use with Rigid Air Ducts.
16. UL 181B: Closure Systems for Use with Flexible Air Ducts and Air Connectors.
17. International Mechanical Code 2009 Edition.
18. International Energy Conservation Code 2009 Edition.

B. Fire and smoke rating test standards: ASTM-E84, NFPA-255 and ANSI/UL-723.

C. Duct sizes indicated are internal sizes.
   1. Where acoustical liner is applied to interior of a duct, increase size to maintain interior dimensions.

D. Related Sections:
   1. 20 07 00 Pipe Duct and Equipment Insulation.
   2. 07 72 13 Prefabricated Roof Curbing.
   3. 20 05 00 Special Mechanical Requirements.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Ductwork layout at 1/4 IN to 1 FT scale.
      a. Layout drawings to include sign-off from balancing contractor indicating the contractor has reviewed the documents to ensure volume damper installation is in compliance with the requirements of this section.
      b. Shop drawings may not be copied, traced, or any other reproduced version of the construction documents.
      c. Shop drawings should show progress from coordination with other trades, ductwork elevations, fittings, joints, sheet metal gauges, and any other pertinent information related to the layout, installation, or construction of the ductwork.

B. Product Data:
   1. Ductwork and fittings, high pressure.
   2. Dampers, nonrated.
   3. Dampers, fire.
   4. Dampers, smoke.
   5. Dampers, combination fire and smoke.
   6. Diffusers, registers and grilles.
   7. Sound Attenuators.
   8. Combination Louvers.
   9. Pressure relief doors.
   10. Control dampers (less actuators).

C. Contract Closeout Information:
   1. Operating and maintenance data for applicable devices such as: fire and smoke dampers, control dampers and combination louvers.

2. Test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Flat oval and round spiral ductwork, high pressure:
   1. Base:
      a. United McGill Airflow Corporation.
   2. Optional:
      a. Semco Incorporated.
      b. Sheet Metal Connectors, Inc.
      c. Eastern Sheet Metal, Inc.
      d. Spiral Pipe of Texas.
      e. Waldinger Corp.

B. Factory fabricated duct connection systems:
   1. Base:
      a. Ductmate Industries.
   2. Optional:
      a. Nexus.
      b. Ward Industries, Inc.

C. Sealants, mastics and adhesives:
   1. Base:
      a. Hardcast.
   2. Optional:
      a. United McGill Airflow Corporation.
      b. Foster (Division of HB Fuller).

D. Turning vanes:
   1. Base:
      a. Aerodyne Controls.
   2. Optional:
      a. Airsan.
      b. Tuttle & Bailey.
      c. Titus.
      d. VentProducts.

E. Flexible fan connections:
   1. Base:
      a. Ventfabrics.
   2. Optional:
      a. Duro-Dyne.
      b. Elgin.

F. Flexible duct, preinsulated:
   1. Base:
      a. Atco.
   2. Optional:
      a. Flexible Technologies, Thermaflex.
      b. Hart and Cooley.
      c. Flexmaster.

G. Access doors, low pressure:
   1. Base:
      a. Ruskin Manufacturing.
   2. Optional:

a. Air Balance.
b. Nailor-Hart Industries, Inc.
c. Ventfabrics.
d. CESCO products.
e. Safe-Air of Illinois.

H. Access Doors, low and high pressure:
1. Base:
a. Ductmate.
2. Optional:
a. Ward Industries.
b. United McGill Airflow Corporation.

I. Acoustical duct liners:
1. Base:
a. Knauf Fiber Glass..
2. Optional:
a. CertainTeed Insulations.
b. Owens-Corning Fiberglass.
c. Johns Manville Corporation.

J. Dampers (manual, backdraft, and control):
1. Base:
a. Ruskin Manufacturing.
2. Optional:
a. Arrow Louvers and Dampers, Inc.
b. American Warming & Ventilating.
c. Air Balance.
d. Cesco Products.
e. Greenheck.

K. Fire and smoke dampers:
1. Base:
a. Ruskin Manufacturing.
2. Optional:
a. Air Balance.
b. Greenheck.
c. Nailor-Hart Industries, Inc.
d. Prefco Products.
e. Safe-Air of Illinois.
f. CESCO products.
g. Pottorff.

L. Diffusers, registers and grilles (except laminar flow in ceiling systems and radial throw diffusers):
1. Base:
a. Titus.
2. Optional:
a. Anemostat Air Products.
b. Carnes.
c. Tuttle & Bailey.
d. Krueger.
e. Price.

M. Sound Attenuators:
1. Base:
a. Industrial Acoustics.
2. Optional:

a. AeroSonics.
b. Ruskin Sound Control.
c. Semco Incorporated.
d. McGill AirSilence, LLC.
e. Vibro-Acoustics.
f. Commercial Acoustics.

N. Air blenders:
1. Base:
a. Blender Products
2. Optional:
a. Kees.

O. Combination louvers:
1. Base:
a. Ruskin Manufacturing.
2. Optional:
a. Arrow.
b. Louvers and Dampers, Inc.
c. VentProducts.
d. Airline.

P. Pressure relief doors:
1. Base:
a. Kees.
2. Optional:
a. United Enertech.

Q. Sheetmetal Insulated Plenum Wall:
1. Base:
a. United McGill Sheet Metal.
2. Optional:
a. Semco.
b. Industrial Acoustics Company.
c. Ruskin.

R. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Sheet metal:
1. Galvanized steel (G90): ASTM-A653/A653M.

B. Duct sealer: NFPA rating of "Non-Combustible".
1. Flame spread rating: 25 or lower, in dry condition.
2. Smoke developed rating: 50 or lower, in dry condition.
3. Resistant to water and water vapors.
4. Pressure rupture rating: 16 IN WG , minimum.
5. Durkee-Atwood Permatite Class I Duct Sealer; Hardcast Iron Grip 601 and Duct Seal 321; or United McGill Sheet Metal Uni-Mastic 181 Duct Sealer and United Duct Sealer.

C. Solder: ASTM-B23, Grade-50B.

D. Duct sealing tape: NFPA rating of "Non-Combustible".
1. Flame spread rating: 25 or lower, in dry condition.
2. Smoke developed rating: 50 or lower, in dry condition.
3. Adhesive: Specifically compounded for maximum adhesion to galvanized and stainless steel.
4. Listings/Labels: UL 181A or UL 181B.

E. Duct liner adhesive and mastic: NFPA rating of “Non-Combustible”.

1. Flame spread rating: 25 or lower, in dry condition.
2. Smoke developed rating: 50 or lower, in dry condition.
3. Adhesive: Specifically compounded for maximum adhesion to galvanized and stainless steel ductwork.
4. Listings/labels: UL 181A or UL 181B

F. RTV foam: UL listed room temperature vulcanized silicone rubber foam.

2.3 DUCTWORK

A. Ductwork - general:
1. Maintain full areas and suitable shapes at every point.
2. Shapes may be changed to fit unusual space conditions.
   a. Cross sectional area to be maintained.
   b. Modifications increasing system pressure drop require Architect approval.
   c. Modifications increasing aspect ratio beyond 5:1require architect approval.
3. Provide necessary transitions and offsets to complete systems.
4. All systems shall be constructed of G90 galvanized steel, except as follows:

B. Ductwork, low pressure, sheet metal:
1. Construct in accordance with SMACNA HVAC Duct Construction Standard per appropriate SMACNA table.
   a. Ductwork for systems operating between 2 IN WG and 3 IN WG static pressure, positive or negative:
      1) Rectangular duct.
      2) Round spiral seam duct.
   b. Ductwork systems operating under 2 IN WG positive or negative:
      1) Rectangular duct.
      2) Round duct: spiral or longitudinal seam.
2. Low pressure ductwork includes but is not limited to:
   a. Supply ductwork on outlet side of single and dual duct air terminal units.
   b. Return, relief air, and outside air ductwork.
   c. Exhaust air ductwork from air inlets to air terminal units (e.g. isolation exhaust system).
   d. Exhaust air for other exhaust systems operating less than 3 IN WG static pressure, positive or negative.
   e. Supply ductwork for constant volume systems without air terminal units.
3. Transverse joints, rectangular:
   a. Ducts with longest side 36 IN and longer:
      1) Use factory fabricated flanged duct connection systems (e.g. Ductmate 35/25 slide on systems).
      2) Non-proprietary SMACNA defined T-22 or T-24 flanged connections
      3) Seal transverse flanged duct connections with pressure sensitive, high density, closed cell, neoprene or polyurethane tape gasket.
   b. Ducts with longest side shorter than 35 IN :
      1) Flanged duct connection systems as defined above are optional.
      2) Refer to SMACNA HVAC Duct Construction Standard for proper duct construction.
4. Longitudinal seam: Use Pittsburgh lock seam only.
5. Seal low pressure ducts to Seal Class A requirements.
6. Runouts to diffusers, register and grilles: Flexible ducts may be used.
   a. Exception: Flexible ducts may not pass through smoke or fire rated walls, floors or ceilings.
   b. Maximum flexible duct length: 3 FT .
   c. Minimum turning radius:
      1) As recommended by manufacturer.
      2) Do not kink, bend or restrict free area of duct as to generate additional pressure drop or noise.

C. Ductwork, high pressure:
   1. Construct in accordance with SMACNA HVAC Duct Construction Standard as follows:
      a. Rectangular duct: Table 1-7, 4 IN WG static pressure, positive or negative.
      b. Round duct: Table 3A & Fig. 3-2B & Figures 3-1 through 3-5, 4 IN WG static pressure.
      c. Flat oval duct: Table 3-4 & Figure 3-6, 4 IN WG static pressure.
   2. Transverse joints, rectangular:
      a. Use factory fabricated flanged duct connection systems (e.g. Ductmate 35/25 slide on systems).
      b. Non-proprietary SMACNA defined T-22 or T-24 flanged connections
      c. Seal transverse flanged duct connections with pressure sensitive, high density, closed cell, neoprene or polyurethane tape gasket.
   3. Longitudinal seam: Pittsburgh lock seam.
   4. High pressure ductwork includes:
      a. Supply ductwork from air handling unit discharge to connection with single and dual duct air terminal units.
      b. Exhaust or return ductwork for other exhaust systems operating over 3 IN WG static pressure.
   5. Runouts to air terminal units: Rigid or flexible ductwork.
      a. Exceptions:
         1) Flexible ducts may not pass through smoke or fire rated walls, floors or ceilings.
         2) Flexible ducts shall not be used for connections to air terminal units for exhaust or return systems.
         3) Flexible ducts may not be used on units located in rated corridors or corridors requiring smoke tight construction.
      b. Maximum flexible duct length: 3 FT .
      c. Minimum turning radius:
         1) As recommended by manufacturer. Do not kink, bend or restrict free area of duct as to generate additional pressure drop or noise.
   6. Seal high pressure duct to seal Class A requirements.

D. Duct hangers and supports: In accordance with following:
   1. High and low pressure ductwork (sheet metal): SMACNA HVAC Duct Construction Standard.

E. Duct fittings and joints on low pressure systems:
   1. Radius elbows without vanes: Radius ratio (R/W) of 1.5 and greater.
   2. Radius elbows with vanes: Radius ratio (R/W) less than 1.5; use where space limitations occur.
      a. R/W = 0.75 to 1.0: Provide 3 vanes in elbow.
      b. R/W = 1.0 to 1.25: Provide 2 vanes in elbow.
      c. R/W = 1.25 to 1.5: Provide 1 vane in elbow.
      d. Provide vane spacing per SMACNA HVAC Duct Construction Standards.
   3. Where square elbows are indicated or required, provide with turning vanes.
   4. Connections to diffusers, grilles and registers: Fitted securely to necks or collars provided behind diffuser, grille, or register face area.
   5. Branch connections:
      a. Round: Factory built short cone or bellmouth type. Air scoops are not acceptable.
      b. Rectangular: 45 degree entry type or radius elbow.
   6. Provide necessary transition pieces and duct collars to make connections to ductwork from neck sizes scheduled or indicated on drawings.
   7. Where building walls, floor and ceilings form portions of duct or plenum, provide gasketed angles or channels at junction points, securely bolted to building structure.

F. Duct fittings and joints on high pressure systems:
   1. Elbows 3-8 IN diameter: Die stamped, for minimum air friction loss, with continuous corrosion resistance welds.

2. Elbows over 8 IN diameter: Welded segment type, not less than 5 pieces for 90 degree elbows, and not less than 3 pieces for 45 degree elbows, using corrosion resistant welds.
3. Tees: "Low loss, short cone type", unless specifically detailed otherwise for space limitations.
4. "Y's" 45 degree type. 60 degree type may be used if space conditions dictate.
5. Install "Y's" as indicated.
6. Where tees are indicated, "Y's" may be substituted if space is available.
7. "Y's": Straight sided type (no cone).
8. Takeoffs from air handling unit plenums: Standard Bellmouth fittings.
   a. Construct in accordance with SMACNA HVAC Duct Construction Standards.
9. "Y" takeoffs from horizontal ceiling mounted ducts to serve boxes: May be straight sided, shop fabricated type by accurately cutting and welding "Y's" into spiral ducts without use of fittings.

G. Turning vanes: For square elbows.
1. Velocities up to 2500 FPM : Single vane, runner Type 2, with 3/4 IN trailing edge, 2 IN vane radius and 1.5 IN vane spacing, minimum 24 GA.
   a. For widths over 36 IN install vanes in 2 or more sections or use tie rods to limit unbraced vane length.
2. Where inlet and outlet dimensions of elbows are not equal, set 2 or more sections at 45 degrees angle to give optimum turning.
3. Radius elbows without vanes: Radius ratio (R/W) of 1.5 and greater.
4. Radius elbows with vanes: Radius ratio (R/W) less than 1.5; use where space limitations occur.
   a. R/W = 0.75 to 1.0: Provide 3 vanes in elbow.
   b. R/W = 1.0 to 1.25: Provide 2 vanes in elbow.
   c. R/W = 1.25 to 1.5: Provide 1 vane in elbow.
   d. Provide vane spacing per SMACNA HVAC Duct Construction Standards.
5. Where square elbows are indicated or required, provide with turning vanes.

H. Partitions and blank-off plates:
1. Where used as part of an air handling unit, construct of 14 GA sheet metal with 1-1/2 IN standing seams.
2. Partitions 8 FT long or less: Provide additional bracing of 1-1/2 x 1/4 IN angles spaced 2 FT on center.
3. Partitions over 8 FT long: Provide additional bracing of 2 x 1/4 IN angles spaced 2 FT on center.

I. Flexible fan connections:
1. Material: Neoprene double coated closely woven glass fabric flexible connections.
2. Fasten fabric to sheet metal duct work and to fan collar extension with 3/16 IN rivets spaced not more than 5 IN OC.
3. Locate in inlet and outlet of fans, as close to fan as possible.
4. Provide at ducts crossing building expansion joints and as indicated on drawings.
5. Connections shall not be under tension.
6. Provide minimum separation distance of 1 IN across the connection.

J. Flexible ducts, preinsulated:
1. Low pressure construction:
   a. Liner: Steel wire helix encapsulated with chlorinated polyethylene (CPE) film.
   b. Insulation: 1 IN x 3/4 LB/CF fiberglass insulation, minimum resistance of R-6.
   c. Jacket:
      1) Bi-directional metalized polyester.
      2) Permeability: Not to exceed 0.05 perms when tested in accordance with ASTM E96 Procedure A.
   d. As applicable, all flexible products or assemblies to meet local or state code requirements

2. High pressure construction:
   a. Liner: Heavy gauge corrugated aluminum with watertight continuous lock seams.
   b. Insulation: 2IN x 1 LB/CF fiberglass insulation, minimum resistance of R-6.
   c. Jacket:
      1) Bi-directional metalized polyester.
      2) Permeability: Not to exceed 0.05 perms when tested in accordance with ASTM E96 Procedure A.
      3) Flex duct must also meet any other local or state requirements for flexible duct construction and performance.
3. Rated working pressure:
   a. Low pressure duct: Positive 4 IN WG minimum; negative 1 IN WG minimum, for return or exhaust air connections.
   b. High pressure duct: Positive 8 IN WG minimum; negative 8 IN WG minimum for return or exhaust air connections
4. Fire resistant, self extinguishing, UL-181, Class 1, with flame spread of 25 or less and smoke development not to exceed 50.
5. Thermal conductance(C): 0.23 BTU/ h-FT^2-F .
6. Low pressure connections:
   a. Secure duct to collar or sleeve with screws, or metal or nylon clamps or bands.
   b. Seal connection with 2 wraps of duct tape.
7. High pressure connections:
   a. Secure duct to collar or sleeve with duct sealer and 1/2 IN aluminum or galvanized steel bands or clamps.
   b. Secure insulation jacket with 2 wraps of duct tape.
8. Turn radius: Not less than R/D equal to 1.0.
9. Provide flexible duct supports in accordance with SMACNA HVAC Duct Construction Standards.
10. As applicable, all products or assemblies to meet local or state code requirements.

K. Access doors:
1. Provide at fire dampers, smoke dampers, fire and smoke dampers, duct mounted automatic dampers, duct mounted coils (except air terminal unit reheat coils) and at other locations indicated on drawings. Access doors shall be positioned to permit easy visual inspection and to allow maintenance and resetting of the device served. Increase duct dimensions at devices when necessary to accommodate required access. Wherever possible, access doors shall be installed above accessible lay-in ceilings. Where access doors are installed above gypboard ceilings or within shafts, provide access panels per Section 20 05 00.
2. Low and high pressure ductwork:
   a. Construction: Access doors shall be removable, double wall construction with 1 IN thick fiberglass insulation, closed cell neoprene gasket and attachment bolts. to provide an air tight seal up to static pressures of 20 IN WG.
   b. Sizes shall be as follows:
      1) For ducts 18 IN and under, the minimum door size shall be 10 IN X 6 IN.
      2) For ducts 19 IN to 24 IN, the minimum door size shall be 16 IN X 12 IN.
      3) For ducts over 24 IN the minimum door size shall be 24 IN X 18 IN.
   c. To install doors in round ducts or rounded side of flat oval duct, provide duct boot.

2.4 ACOUSTICAL DUCT LINER

A. Acoustical duct liner: Flexible mat-faced fiberglass.
1. Meet NFPA-90A and NFPA-90B Standards for fire safety.
2. Comply with erosion test of UL-181.
3. Thermal conductivity (k factor): 0.26 BTU-IN/SF- degF-HR at 75 degF mean temperature.
4. Density:
   a. 2 LB/CF for 1/2 IN thick liner.
   b. 1-1/2 LB/CF for 1 IN thick liner.
5. Sound Absorption Coefficient at NRC: As determined by ASTM-C1071 and ASTM-C423.

B. Scope: Provide acoustical duct liner in following duct systems:
   1. Return air ductwork: 1/2 IN thick.
      a. Refer to ductwork drawings for application.

2.5 DAMPERS

A. Dampers - general:
   1. Sizes and types: As indicated.
   2. Locate as indicated.
   3. Factory built and assembled dampers.

B. Dampers, manual (rectangle and square):
   1. Opposed blade type, fitted with shank bolts, marked for direction (open/closed).
   2. Provide locking hand quadrant, with 2 IN standoff bracket.
   3. Construction:
      a. Greater than 36 x 12 IN :
         1) Frame: 16 GA galvanized steel formed into structural shape.
         2) Blades: 16 GA galvanized steel, equipped with brass pin running on stainless steel pivot for vertical axis.
         3) Axles: Continuous, steel 1/2 IN hex.
         4) Basis of design: Ruskin MD35.
      b. 36 x 12 IN and less:
         1) Frame: 22 GA galvanized steel, flat or angle.
         2) Blades: 22 GA galvanized steel, equipped with brass pin running on stainless steel pivot for vertical axis.
         3) Axle: Continuous, steel 3/8 IN hex.
         4) System pressure and velocity rating: 2.5 IN WG and 1500 fpm .
         5) Basis of design: Ruskin MD25 or MD15.

C. Damper, manual (round):
   1. Butterfly type with circular blade mounted to shaft.
   2. Frame: Minimum 20GA galvanized steel 7 IN segment duct.
   3. Blade: Minimum 20 GA galvanized steel.
   4. Shaft: Continuous, Steel 3/8 IN hex.
   5. System pressure and velocity rating: 2.5 IN water gauge and 1500 fpm.
   6. Hand quadrant: Locking type with 2 IN standoff bracket.
   7. Bearings: Self-lubricating nylon or stainless steel sleeve.
   8. Basis of design: Ruskin MDRS25.

D. Dampers, backdraft, low pressure:
   1. Counterbalanced, gravity operated.
   2. Fabricate of aluminum.
   3. Blades: Provided with common linkage rod and felt seals.

E. Dampers, control:
   1. Frame: hat channel construction; 16 gage galvanized steel, 16 gauge stainless steel or extruded aluminum.
   2. Blades: Two layers of 22 gage galvanized steel mechanical joined sheets or extruded aluminum, airfoil shaped, 6 IN wide.
   3. Seals: Extruded vinyl blade edge seals and flexible metal compressible jamb seals.
   4. Bearings:
      a. Aluminum frame construction: synthetic bearings.
      b. Galvanized or stainless steel construction: Stainless steel sleeve or ball bearing.
   5. Temperature rating: -40 to 200 deg F .
   6. Pressure and velocity rating: 4 IN WG pressure differential at 2000 FPM .
   7. Blade arrangement: All control dampers shall be opposed blade, except outside air and return air control dampers shall be parallel blade and shall be arranged to promote mixing.
   8. Actuators: See Section 25 50 00.

9. Example:
    a. Aluminum frame construction: Ruskin CD50.
    b. Galvanized frame construction: Ruskin CD60.

2.6 FIRE DAMPERS

A. Fire dampers - general:
1. UL labeled, 1.5 Hour rated (unless otherwise indicated).
2. Fire dampers shall have 165 degF fusible link, except as follows:
    a. For exhaust and return systems, which are part of a smoke control system, the fusible link temperature shall be 285 degF .
    b. Fire dampers in dishwasher and cartwash exhaust systems shall have 285 degF fusible link.
3. Fire dampers shall be dynamic type.
4. Provide as indicated and as required by NFPA and local regulations.
5. Provide with mounting angles and sleeves.
6. For curtain-type fire dampers, blades must be out of air stream (Type B fire damper), except as follows:
    a. Fire dampers with blades in the airstream (Type A fire damper): where dampers are installed at a wall mounted grille and ductwork is not installed on both sides of the wall penetration.
    b. For ducts where the smallest dimension is 8 IN m or less : fire dampers (Type C fire damper) shall be 1 IN larger in each dimension and both the frame and the blades must be out of the air stream. This is not required at locations where fire dampers are installed at wall mounted grilles (see above).
7. On round or flat oval ductwork, provide dampers in enclosure with round or oval connections on each side.

B. Fire dampers in low pressure ducts:
1. Provide curtain type damper, Ruskin Model DIBD2.
    a. Rated up to 2000 FPM at 4 IN WG for vertical mounted applications.
    b. Rated up to 2000 FPM at 4 IN WG for horizontal mounted applications.

C. Fire dampers in high pressure ducts:
1. For vertical mounted applications: curtain type damper, Ruskin Model DIBDX2.
    a. Rated up to 4000 FPM at 8 IN WG .
2. For horizontal mounted applications: curtain type damper, Ruskin Model DIBD2.
    a. Rated up to 2000 FPM at 4 IN WG .

D. Ceiling fire dampers:
1. UL listed specifically for floor/ceiling assemblies.
2. Provide Ruskin CFD Series radiation damper suitable for type of diffuser, register, and grille.
3. Provide mineral wool thermal insulating blanket for back side of diffuser, register, or grille as required by the manufacturer to comply with listing of damper.

2.7 SMOKE DAMPERS

A. Smoke dampers - general:
1. UL classified as a leakage rated damper for use in smoke control systems under UL555S, latest edition, and bear a UL label attesting to same.
2. Suitable for velocity and pressure of system.
3. Jamb seals: Stainless steel flexible metal compression type.
4. Provide in ductwork adjacent to smoke partition (not in wall) with actuator in accessible location and visible for inspection.
5. Provide dampers and actuators as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators as a rated assembly.
6. Frame: 16 GA galvanized steel, minimum.

7. Loss through wide open damper based on AMCA Test Figure 5.3:
    a. 12 IN x 12 IN duct size: Not more than 1.25 IN WG at 3000 FPM face velocity.
    b. 24 IN x 24 IN duct size: Not more than 0.45 IN WG at 3000 FPM face velocity.
    c. 36 IN x 36 IN duct size: Not more than 0.3 IN WG at 3000 FPM face velocity.
8. Provide factory supplied caulked sleeve.
9. Provide smoke dampers as indicated.

B. Smoke dampers, low pressure:
1. Parallel blade type with blades hinged together for operation in unison and bearings arranged for automatic operation.
2. UL555S Leakage Rating: Class I (4 CFM/ SF at 1 IN WG).
    a. Ruskin Model SD37.
3. Blades: Single or double thickness type.
    a. Single thickness type: 16 GA steel, minimum.
    b. Double thickness type: 18 GA steel.
4. Blade width: Not more than 6 IN .
5. Single blade dampers may be used for up to 8 IN wide blade, or up to 12 IN round.
6. Provide factory mounted resettable link and switch package with open and closed indicator and factory mounted momentary switch to allow damper to be tested at the damper.

C. Smoke dampers, square or rectangular, high pressure:
1. Parallel or opposed blade type with linkage for automatic operation.
2. UL555S Leakage Rating: Class I (8 CFM/ SF at 4 IN WG).
    a. Ruskin Model SD60 or SD50.
3. On round or flat oval ductwork:
    a. Provide dampers in an enclosure with round or oval connections on each side.
4. Provide factory mounted resettable link and switch package with open and closed indicator and factory mounted momentary switch to allow damper to be tested at the damper.

D. Smoke dampers, round or flat oval, high pressure:
1. Single blade type with encompassed blade edge seal.
2. Provide factory mounted resettable link and switch package with open and closed indicator and factory mounted momentary switch to allow damper to be tested at the damper.
3. UL555S Leakage Rating: Class I (8 CFM/ SF at 4 IN WG).
    a. Ruskin Model SDRS25.

E. Damper actuator (operator): Electric type, factory installed.
1. Two-position type.
2. 120 VAC.
3. Spring return fail closed.
4. UL listed at 250 degF.

2.8 COMBINATION FIRE-SMOKE DAMPERS

A. Fire-smoke dampers, combination - general:
1. UL classified as a Leakage Rated damper under UL555S, latest edition, bearing a UL label attesting to same.
2. UL555 fire rating: 1.5 Hour.
3. Suitable for velocity and pressure of system.
4. Compressible metal jamb seals.
5. Operator installed per UL requirements, in accessible location and visible for inspection.
6. Provide dampers and actuators as a single entity which meets all applicable UL555 and UL555S qualifications for both dampers and actuators as a rated assembly.
7. Frame: 16 GA galvanized steel, minimum.
8. Loss through wide open damper:
9. Loss through wide open damper based on AMCA Test Figure 5.3:
    a. 12 IN x 12 IN duct size: Not more than 1.25 IN WG at 3000 FPM face velocity.
    b. 24 IN x 24 IN duct size: Not more than 0.45 IN WG at 3000 FPM face velocity.

c. 36 IN x 36 IN duct size: Not more than 0.3 IN WG at 3000 FPM face velocity.

10. Provide factory supplied caulked sleeve.
11. Provide fire-smoke dampers as indicated.

B. Fire-smoke dampers, combination, low pressure:
1. Parallel blade type with blades hinged together for operation in unison and bearings arranged for automatic operation.
2. May be used in lieu of separate fire and smoke dampers.
3. UL555S Leakage Rating: Class I (4 CFM/ SF at 1 IN WG).
   a. Ruskin Model FSD37.
4. Fusible link: 165 degF melting point.
5. Provide factory mounted resettable link and switch package with open and closed indicator and factory mounted momentary switch to allow damper to be tested at the damper.

C. Fire-smoke damper, combination, high pressure:
1. Parallel blade type.
2. May be used in lieu of separate fire and smoke dampers.
3. UL555S Leakage Rating: Class I (8 CFM/ SF at 4 IN WG).
   a. Ruskin Model FSD60 .
4. Fusible link: 165 degF melting point.
5. Provide factory mounted resettable link and switch package with open and closed indicator and factory mounted momentary switch to allow damper to be tested at the damper.

D. Actuators, fire-smoke damper: Electric type, factory installed.
1. Two-position.
2. 120 VAC.
3. Spring return fail closed.
4. UL listed at 250 degF.

2.9 DIFFUSERS, REGISTERS AND GRILLES

A. Diffusers, ceiling:
1. Square type.
2. Size, type and manufacturer: As scheduled.
3. Finish of steel units: Factory applied, baked or electrocoated enamel; color as selected by Architect or as indicated.
4. Finish of aluminum units: Satin anodized.
5. Provide sponge rubber gasket for ceiling diffusers.
6. Provide necessary screws, duct collars, transitions and air pattern deflectors.

B. Air grilles and registers:
1. Size, type and manufacturer: As scheduled.
2. Finish of steel units: Factory applied, baked or electrocoated enamel; color as selected by Architect or as indicated.
3. Finish of aluminum units: Satin anodized.
4. Provide sponge rubber gasket for ceiling and wall units.
5. Provide necessary screws, duct collars and transitions.
6. Provide opposed blade dampers in registers where indicated.

C. Diffusers and grilles, linear:
1. Size, type and manufacturer: As scheduled on drawings.
2. Adjustable pattern controller (on supply units only) capable of 180 degree air pattern adjustment and volume control. All adjustments accessible from the face of the diffuser.
3. Extruded aluminum or steel ceiling linear diffuser.

D. Institutional grille:
1. For maximum secure areas: see schedule.

2.10 SOUND ATTENUATORS

A. Sound Attenuators:
   1. Prefabricated, straight through design.
   2. Airflow pressure drop and noise reduction (NR) values as indicated on drawings.
   3. Size and shape as indicated on drawings.
   4. Outer casing: 22 GA, minimum, galvanized steel.
   5. Interior partitions or splitters: 24 GA, minimum, perforated galvanized steel.
   6. Aluminum construction: At least 50 percent thicker than steel specified.
   7. Use straight through air passages.
   8. Use airtight construction.
      a. Make unit leakproof when subjected to differential air pressure of 8 IN WG between outside and inside.
      b. Weld lock joints or seams or fill with mastic.

B. Sound attenuators, noise reduction (NR) rating:
   1. Tests made in such manner as to eliminate end reflections, beaming or directivity, flanking, standing waves, and room absorptions.
   2. Test method may be either "in-duct with anechoic termination" or "reverberant rooms with tunnel between".
   3. Size of units tested: Not smaller than 24 IN x 24 IN rectangular or 24 IN round outside, with full size connections.
   4. Submit corroborative report of tests made in nationally recognized, qualified, independent testing laboratory approved by AMCA for airflow determinations.

C. Sound attenuators, airflow pressure drop rating:
   1. Do not exceed pressure drop at specified airflow(s).
   2. Base rating on results of tests made in manner to provide reliable data.
   3. Basic setup: Standard code method as adopted by AMCA for testing fans.

D. Sound attenuators, acoustical fill:
   1. Inert, vermin and moisture proof, inorganic glass or mineral fiber.
   2. Pack behind partitions or splitters under not less than 5 percent compression to provide "spring" and avoid settling.
   3. Fill containment: totally encapsulated and sealed with a polymer film. Separate fill material from perforated baffle by a non-combustible, erosion resistant, acoustical stand-off. Refer to schedule for applicability.

2.11 SHEET METAL INSULATED PLENUM WALL

A. Plenum wall construction:
   1. Panel thickness: 4 IN .
   2. Minimum panel gauge: 20.
   3. Channel members (perimeter and internal longitudinal): 16 gauge commercial-quality galvanized steel.
   4. Galvanized coating class: ASTM-A653, G-90 on all steel panel surfaces, internal channels and trim items.
   5. Panel construction: The outer and inner shells shall be tack or spot welded to perimeter and internal longitudinal steel channels and box-end internal enclosures.
   6. Panel insulation:
      a. Thermal conductivity (k): Not to exceed .06 BTU per hour per square foot per degree F at mean temperature of 75 degF.
      b. Flame spread rating: Not greater than 25.
      c. Smoke developed rating: Not greater than 50.
      d. Insulation quality: inert, mildew resistant and vermin-proof.
      e. Insulation shall completely fill the panel assembly and shall not settle within the panel assembly.

B. Personal access doors:
   a. Size: 24 inches wide by 66 inches tall.
   b. Thickness and gauge: Same thickness as adjacent panel.
   c. Hinges (number and type): Minimum of two, ball-bearing type.
   d. Door Latches:
      1) Number and type: Minimum of two, wedge-lever type.
      2) Operation: Operable from the interior or exterior sides of the door panel.
   e. Gasketing:
      1) Material: Neoprene.
      2) Installation: entire perimeter of the door frame in such a manner that door operation will provide direct compression with no sliding action between the door and gasket.
   f. Locations:
      1) At least one door for every 45 lineal feet of plenum wall.
      2) Coordinated with mechanical room layouts to avoid conflicts with equipment placement.
2. All framing members shall be insulated, welded and sealed according to the plenum manufacturers published installation details.

C. Structural performance:
1. The entire plenum wall installation shall be designed by the plenum wall manufacturer to be self-supporting.
2. Where roof spans and wall loadings require additional structural strength, it shall be provided by heavier panel skins, additional internal longitudinal reinforcing members, or additional structural members and necessary supporting pipe columns.
3. Provide structural members and pipe columns according to the drawings and published installation details provided by the plenum wall manufacturer.
4. The finished plenum wall installation shall be able to withstand a positive internal static pressure of 2 inches W.G. and a negative internal static pressure of 2 inches W.G.

2.12 AIR BLENDERS

A. Air blenders:
1. Completely fixed devices with no moving parts.
2. Type, size, pressure drop and capacity: As scheduled.
3. Factory built and tested.
4. Fabricated of 14 GA aluminum and welded construction.
5. Capable of providing a minimum mixing effectiveness of 75 percent and plus or minus 6 degF standard deviation when mixing 50 percent outside air with 50 percent return air at 60 degF inlet temperature differential.

2.13 LOUVER BLANK-OFF PANELS

A. Provide blank off panels behind inactive louver sections.
1. Double wall construction with minimum 22 GA galvanized sheet metal.
   a. 2 IN thick rigid insulation.
2. Paint side facing louver flat black.

2.14 COMBINATION LOUVERS

A. Combination louvers:
1. Construction: Extruded aluminum frames, front fixed blades, and rear adjustable blades, drainable.
2. Birdscreen: Aluminum.
3. Seals: Vinyl blade and compressible aluminum jamb.
4. Bearings: Stainless steel sleeve.
5. Frame: 6 IN deep. Contractor shall field verify clearances prior to fabrication.
6. Concealed linkage.

7. Maximum individual section size shall be 48 IN wide by 96 IN high. Larger sizes shall require field assembly of smaller sections.
8. All sections shall be joined together by a common jack shaft with lockable arm to allow damper (adjustable blades) to be adjusted via an actuator as provided under 25 50 00. Locate arm locations to ensure ready access to the actuator.
9. Custom Color as selected by Architect.
10. Minimum free area: 47%
11. Water Penetration of 0.01 oz./sq. ft. at 1169 fpm for a 48" by 48" louver.
12. Size and performance: As indicated.
13. Basis of design: Ruskin ELC6375DAX

2.15 PRESSURE RELIEF DOORS

A. Pressure relief doors:
1. Frame: 12 GA galvanized steel, Z-shaped.
2. Door: 12 GA galvanized steel.
3. Seal: Polyurethane foam around door perimeter.
4. Pressure setting: As indicated.
5. Springs: Negator type for door closure upon loss of over pressurization.
6. Size: 18 IN x 18 IN .
7. Insulation: For supply duct locations, provide 1 IN thick foil faced insulation on the inside surface to prevent condensation.
8. Locations: As indicated.
9. Model: Kees BI or Kees BO as applicable.

PART 3 - EXECUTION

3.1 GENERAL

A. Install and coordinate systems and components.

B. Install air flow measuring stations furnished with Section 25 50 00 in accordance with manufacturer's installation instructions and as specified.

3.2 INSTALLATION OF DUCTWORK

A. Ductwork Cleanliness:
1. Reference Standard: SMACNA – Duct Cleanliness for New Construction.
2. Basic Level:
   a. Under this level of ductwork cleanliness it is acknowledged that ductwork leaving the premises of the manufacturer will include some or all of the following:
      1) Internal and/or external self-adhesive labels or marking for part(s) identification.
      2) Exposed mastic sealant.
      3) Light zinc oxide coating on the metal surface.
      4) A light coating of oil on machine formed ductwork.
      5) Minor protrusions into the airway of rivets, screws, bolts and other jointing devices.
      6) Internal insulation and associated fasteners.
      7) Discoloration marks from plasma cutting process.
   b. The internal surfaces of ductwork shall be wiped to remove excess dust immediately prior to installation.
3. Intermediate Level:
   a. Under this level of ductwork cleanliness it is acknowledged that ductwork leaving the premises of the manufacturer will include some or all of the following:
      1) Internal and/or external self-adhesive labels or marking for part(s) identification.
      2) Exposed mastic sealant.
      3) Light zinc oxide coating on the metal surface.

4) A light coating of oil on machine formed ductwork.
5) Minor protrusions into the airway of rivets, screws, bolts and other jointing devices.
6) Internal insulation and associated fasteners.
7) Discoloration marks from plasma cutting process.

b. Site storage: The area provided for storage shall be clean, dry and exposure to dust minimized.
c. The working area should be clean and dry and protected from the elements.
d. The internal surfaces of ductwork shall be wiped to remove excess dust immediately prior to installation.
e. Open ends on completed ductwork and overnight work-in-progress shall be sealed.

4. Advanced Level:
   a. In addition to the provisions of the Intermediate level the following requirements apply:
      1) All self-adhesive labels for part identification are to be applied to external surfaces only.
      2) To maintain cleanliness during transportation, all ductwork shall be sealed either by blanking or capping duct ends, bagging small fittings, surface wrapping or shrink wrapping.
   b. Site Storage:
      1) A clean and dry environment where the ductwork is protected from dust must be provided for the storage of ductwork prior to installation.
      2) All sealed ends shall be visually examined and if damaged resealed with an appropriate material.
   c. The working area shall be clean, dry and the ductwork protected from dust. Protective coverings shall only be removed immediately before installation and inspected to determine if additional wipe down is necessary.
5. Duct Cleanliness levels by space type:
   a. Advanced Level:
      1) All ductwork as a part of the Courthouse Renovation Project.

B. Install generally as indicated.

C. Conceal ductwork in finished spaces unless indicated otherwise.

D. Do not install ductwork in or allow to enter or pass through electrical rooms, elevator machine rooms, or spaces housing switchboards, panelboards or distribution boards, except ductwork that serves electrical rooms, elevator machine rooms, or spaces.

E. Exercise special care to provide tight fitting well fabricated, well braced ductwork systems.

F. Field assemble rectangular, round or flat oval ductwork as follows:
   1. Use duct joint sealer applied slip joints.
   2. Use Ductmate Spiralmate or Ovalmate systems.
   3. Isolate dissimilar metals with elastomeric sealant tape or fiber gaskets, and gaskets and washers for bolts.
   4. Install TDC flanged duct connection systems in accordance with SMACNA construction standards.

G. In high pressure ductwork, do not use 2 piece mitered 90 degree elbows with or without vanes unless approved by Engineer.

H. Fabricate duct connections for hoods, openings, fans, and other devices.

I. Where ducts pass thru fire rated and smoke rated construction, maintain rating indicated.
   1. Where fire dampers are not used, seal around duct with firestopping.
   2. See Section 07 84 00 for materials.

J. Do not kink, bend or otherwise restrict the free area of flexible ductwork.

K. Ductwork hangers:

1. Install per SMACNA Duct Construction Standards but in no case shall ductwork hangers or ductwork be directly supported to or supported off of other ductwork.

3.3 INSTALLATION OF MANUAL DAMPERS

A. Provide volume dampers, to facilitate air balancing, in the following locations whether shown on the plans or not:
   1. Run-outs to individual room terminal devices (i.e. supply grilles and diffusers, return and exhaust grilles). Locate damper as close to the run-out take off as possible.
   2. Lateral duct take-offs from a return or exhaust main riser for systems serving multiple floors.

B. Provide additional branch main volume dampers required by the balancing contractor, refer to Section 20 08 00.

3.4 INSTALLATION OF FIRE AND SMOKE DAMPERS

A. Install in accordance with manufacturer's instructions and UL requirements.
   1. See Section 07 84 00.

B. Floor mounted dampers may be installed in a concrete floor curb.

3.5 INSTALLATION OF SHEETMETAL INSULATED PLENUM WALL

A. Assembly components and installation:
   1. All plenum base channels shall be installed on a level concrete curb.
   2. All assembly trim items shall be constructed of hot-dipped galvanized steel (minimum 18-gauge thickness).
   3. All mechanical joints and external trim items shall be sealed with a UL-Classified duct sealant.

B. Joints and trim shall be sealed with a solvent-based duct sealant formulated to withstand temperatures from –20 to 300 degrees F.

3.6 PERFORMANCE TESTS

A. Test high pressure air ductwork with air pressure not less than 4 IN WG pressure before external insulation is applied.
   1. As required, test portions of system to permit finish work.
   2. Leakage not to exceed maximum values identified by SMACNA HVAC Air Duct Leakage Test Manual.
   3. Testing procedures shall be as described by SMACNA HVAC Air Duct Leakage Test Manual.
   4. Test all high pressure ductwork systems.
      a. Exception: All high pressure ductwork to be installed on the 4th floor, 1st floor and basement.

B. Test all low pressure ductwork to 1.5 times listed fan operating pressure with 2 IN WG minimum but not greater than duct construction pressure limits. Test ductwork before insulation is applied.
   1. Exception: All low pressure ductwork to be installed on the 4th floor, 1st floor, and basement.

C. Use a pressure blower with volume control and orifice flow meter to provide supply air for test.

D. Submit reports to Architect.

3.7 APPLICATION OF ACOUSTICAL DUCT LINER

A. Apply duct liner to clean, dry surfaces with duct surfaces at room temperature.

B. Apply duct liner in accordance with duct liner installation standards of SMACNA HVAC Construction Standards - Metal and Flexible.

C. Calk joints with fire retardant mastic and point up to smooth surface.

D. Apply adhesives and mastics per manufacturer's recommendations.

E. When duct width exceeds 8 IN, provide additional securement with mechanical fastening devices that are spaced in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible.

F. Butt edges tightly and secure to metal surface with adhesive covering 100 percent of duct surface.
   1. Spacing at edges, joints and corner breaks per manufacturer's recommendations.

G. Install metal nosing at upstream transverse edges for velocities over 4000 FT/MIN.

3.8 CLEANING

A. At substantial completion, clean work installed under this section.

3.9 EQUIPMENT DEMONSTRATION

A. At substantial completion, inspect and test, and operate satisfactorily, in presence of Engineer and representative of Owner, operation of each piece of equipment and its accessories.

B. If inspection or test indicates defects, replace defective work or material.

C. Repeat inspections and tests until defects are eliminated.

END OF SECTION

SECTION 23 35 00
EXHAUST AND VENTILATING FANS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Air Terminal Units and Induction Units, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. In-line square centrifugal fans.
   2. Power roof and wall ventilators.

C. Abbreviations:
   1. AMCA: Air Movement and Control Association.
   2. ADC: Air Diffusion Council.
   3. ASHRAE: American Society of Heating, Refrigeration and Air Conditioning Engineers.

D. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Standards:
   1. ADC Standard 1062R2, Air Diffusing Equipment Test Code.
   2. AMCA Standard 210, Laboratory Methods of Testing Fans for Aerodynamic Performance Rating.
   3. AMCA Standard 204, Balance Quality and Vibration Levels for Fans.
   4. ASHRAE Standard 70, Method of Testing for Rating the Performance of Air Outlets and Inlets.
   5. NFPA-90A, Standard for the Installation of Air Conditioning and Ventilating Systems.
   6. ASTM B117-03: Standard Practice for Operating Salt Spray(Fog) Apparatus.
   7. ABMA : American Bearing Manufacturers Association.

1.3 SUBMITTALS

A. Product Data:
   1. Performance data.
   2. Physical dimensions.
   3. Fan curves.
   4. Sound data.

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Fans (General):
   1. Base:
      a. Members of AMCA.

B. In-line square centrifugal fans:
   1. Base:
      a. Geenheck

2. Optional:
    a. Carnes.
    b. Cook, Loren.
    c. PennBarry.
    d. Twin City Fan & Blower.
    e. Acme Engineering and Manufacturing.

C. Power roof and wall ventilators:
1. Base:
    a. Greenheck
2. Optional:
    a. Carnes.
    b. Acme Engineering and Manufacturing.
    c. Cook, Loren.
    d. Jenn Industries.
    e. PennBarry.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Fans - General:
1. Performance ratings: Based on laboratory tests conducted in accordance with latest edition of ASHRAE/AMCA Standard Test Codes.
2. UL 705 listed.
3. Capacity and ratings: As indicated.
4. Arrangement and drive: As indicated.
5. Provide removable belt guard.
6. Fan drive sheaves for belt driven fans over 5 HP:
    a. Cast iron, split tapered bushings dynamically balanced at factory.
    b. Provide initial fixed pitch sheave based upon design conditions.
    c. Provide final fixed pitch drive sheaves for proper RPM determined during balancing process.
7. Belt driven fans 5 HP and less: Provide with adjustable sheaves.
8. Fan wheels shall be statically and dynamically balanced per AMCA Standard 204.
9. Finish:
    a. Steel fan components: Finished with paint system exceeding 1000 hour salt spray under ASTM B117 test method, minimum 2 mil thick.
    b. Aluminum, galvanized, and stainless steel fan components: Unfinished.

B. Motors and control: As specified in Section 20 05 00.
1. Provide TEFC motor for outdoor installations exposed to weather.
2. For direct drive fans, provide TEFC motors when motor is located in the airstream.

C. Belt Drives:
1. Single or multiple belts as required to develop full horsepower of driving motor with service factor of not less than 1.50.
2. Where more than one belt is used for drive, provide "matched" sets.
    a. Use new belts on final fixed pitch drive sheaves.
3. Motors on fan drive: Provide with adjustable rail motor mounts of type using screws for tightening of belts.
4. Bolt motor mounts to fan bases or frames.
5. For fans suspended from ceilings, belt tightening device may be pivoted type.

D. Belt guards: As specified in Section 20 05 00.

E. Control Dampers:
1. Control dampers shall be as specified in Section 23 31 13.
2. Actuator for control dampers shall be as specified in Section 25 50 00.

2.3 IN-LINE SQUARE CENTRIFUGAL FANS

A. General:
   1. Direct or belt drive, as indicated.

B. Housing:
   1. Constructed entirely of minimum 18 gauge galvanized steel.
   2. Inlet bell.
   3. Prepunched inlet and outlet flanges.
   4. Bolted, gasketed access door located on three sides.

C. Fan wheel:
   1. Centrifugal type, aluminum construction.
   2. Backward inclined shaped blades.
   3. Statically and dynamically balanced.

D. Bearings:
   1. Bearings shall be fixed to the fan shaft using concentric mounting locking collars. Set screws will not be allowed.
   2. Self aligning, extra heavy duty type, ball or roller bearings with regreasable lubrication.
   3. Select for minimum average bearing life L-50 rating of 200 000 hours operation at maximum cataloged operating speed.

2.4 POWER ROOF AND WALL VENTILATORS

A. Power roof and wall ventilators:
   1. Centrifugal, direct or belt driven as scheduled, wall or curb mounted type as scheduled
   2. Capacity: As scheduled.
   3. Housing: Extruded or heavy gauge sheet aluminum mounted on rigid support structure.
      a. Hooded dome type.
      b. Square base to match roof curb.
   4. Motor and drive: Isolated from exhaust air stream.
      a. Provide overload protection.
      b. Isolate each fan motor and drive from enclosure with internal vibration isolators.
      c. Resiliently mounted motors may be used for direct drive fans.
   5. Fan wheel: Backward inclined, dynamically and statically balanced.
   6. Bearings:
      a. Bearings shall be fixed to the fan shaft using concentric mounting locking collars. Set screws will not be allowed.
      b. Self aligning, extra heavy duty type, ball or roller bearings with regreasable lubrication.
      c. Select for minimum average bearing life L-50 rating of 200 000 hours operation at maximum cataloged operating speed.
   7. Provide factory prefabricated, insulated roof curbs.
   8. Provide 1/2 IN mesh birdscreen on outlet.
   9. Provide factory wired NEMA 1 disconnect under cover.
   10. Provide factory wired, solid state speed controller, on direct drive 120 volt, single phase fans.

2.5 PREFABRICATED, INSULATED ROOF CURBS

A. Construction:
   1. Curb height: 12 IN, above finished roof.
   2. Style: Straight sides (without cants) to accommodate tapered roof insulation. Roof curbs shall be approved by roofing manufacturer and compatible with roofing system.
   3. Shell, liner, and base: G90 galvanized steel with fully mitered and welded corners, integral base plates.
   4. Insulation: Factory applied, 1-1/2 IN thick, 3 PCF density fiberglass insulation.
   5. Nailers: Factory installed pressure treated wood.
   6. Provide level installation, regardless of roof slope.

2.6 VIBRATION ISOLATION

A. Vibration isolation: Section 20 05 50.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's recommendations and as specified.

B. Caulk roof curbs for watertight installation.

C. Coordinate placement of equipment on roof with other trades.

3.2 VIBRATION ISOLATION

A. Vibration isolation: Section 20 05 50.

3.3 FAN DYNAMIC BALANCING

A. Experienced, trained mechanics from factory shall dynamically balance centrifugal fans 7-1.2 HP and above. Balancing shall include the following:
   1. Inspection of fans to determine if damage has occurred during storage or installation and coordinate repair of damages.
   2. Inspection of fan drives including bearing and motor mounts.
   3. Inspection of tensioning of drive belts on adjustable and fixed pitch sheaves.
   4. X-Y dynamic vibration plot on each fan resulting in a properly balanced installation within factory specifications, performed after system has been balanced and final fixed pitch drive sheaves installed.

END OF SECTION

SECTION 23 36 00
AIR TERMINAL UNITS AND INDUCTION UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Air Terminal Units and Induction Units, as indicated, in accordance with provisions of Contract Documents.

B. Systems Included:
   1. Air terminal units.

C. Operators and controllers:
   1. Operators and controllers for air terminal units: Provided in Section 25 50 00.

D. Definitions:
   1. Low pressure ductwork:
   2. High pressure ductwork: refer to section 23 31 13.

E. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Design and installation standards:
   1. ASHRAE Guide and Data Book – Systems and Equipment, current chapter on duct construction.
   2. Air Diffusion Council, ADC Standard 1062R2, Air Diffusing Equipment Test Code.
   3. Air Moving and Conditioning Association, AMCA Standard 210, Test Code for Air Moving Devices.
   4. ASHRAE Standard 70-72, Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
   5. NFPA-90A, Standard for the Installation of Air Conditioning and Ventilating Systems, current edition.
   6. SMACNA HVAC Duct Construction Standard - Metal and Flexible current edition.
   7. UL Publication No.181, Erosion Test Methods.
   8. ARI 885-98: Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets.

1.3 SUBMITTALS

A. Product Data:
   1. Air Terminal units.

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Air terminal units:
   1. Base:
      a. Titus
   2. Optional:
      a. Anemostat Air Products.

b. Krueger.
c. Price.
d. Trane.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Air Terminal Units
1. Air terminal units - general: Factory assembled.
   a. Configured for pressure independent control.
   b. Capacity: As indicated.
   c. Noise level: Based on ARI 885-98. Refer to plans for scheduled values.
   d. Operators: Furnished in Section 25 50 00.
      1) Factory or field installed on units.
      2) Provide two operators per air terminal unit for dual duct applications.
   e. Acoustical fiberglass liner:
      1) Comply with NFPA-90A for fire resistivity and UL Standard 181 for erosion.
      2) Insulation shall consist of 1 IN thick non-porous foil faced rigid fiberglass insulation secured by full length galvanized steel z-strips which enclose and seal all edges, eliminating tape and adhesives.
   f. Provide multi-point velocity pressure sensors with external pressure taps.
   g. Provide static pressure tube(s).
   h. Valve adjustment: Field adjustable.
   i. Set air terminal units to air flow rates indicated.
   j. Casing leakage: 5 percent, maximum, of nominal rated capacity at 3.0 IN WG internal pressure.
2. Heating and cooling coils for air terminal units: ARI certified, continuous plate or spiral fin type, leak tested at 300 PSI.
   a. Capacity: As indicated, based on scheduled entering water temperature.
   b. Headers: Copper or brass.
   c. Fins: Aluminum, maximum 8 fins per IN.
   d. Tubes: Copper, arrange for counter-flow of heating water.
   e. Water velocity: 8 FPS maximum with head loss not greater than indicated.
   f. Provide 20 GA galvanized steel casing with slip and drive construction for attachment to metal ductwork.
   g. Provide vent and drain connection at high and low point, respectively, of each coil.
   h. Coils guaranteed to drain.
3. Inlet air valves for air terminal units: Corrosion resistant, self-seating type.
   a. Frame, links and levers may be of zinc coated steel or aluminum.
   b. Vanes, pivots, hinged or knuckle joints: Aluminum or other non-ferrous metal.
   c. Leakage: Not greater than 3 percent of maximum rated capacity when closed against inlet static pressure of 4.0 IN WG.
   d. Equip with suitable linkage and motor mounting platform to accommodate control operators.
   e. Use resilient sealing members to prevent leakage.
   f. Provide direct reading air flow rate scale and external adjustment.
4. Air terminal units, dual duct: Factory assembled as a single unit with sound-attenuation box, 2 air valves, manual air-balancing mechanism, automatic operators, and air outlets.
   a. Mixing unit: Blend air from hot air and cold air valves to temperature within ratio of 1degF to each 10 degF of temperature difference between hot and cold supply duct temperatures.
   b. Provide variable air volume.
5. Air terminal units, single duct, with coils: Constant or variable volume, high velocity unit with reheat coil, as indicated.
   a. Construction: 22 GA galvanized steel or 0.040 IN aluminum, minimum.

b. Sound Attenuators: Refer to plans and specification section 23 31 13 for locations and requirements.
c. Sound Attenuators: Provide where indicated on plans.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install units as indicated and in accordance with manufacturer's recommendations and instructions and as specified.

END OF SECTION

SECTION 23 57 00
HEAT EXCHANGERS AND CONVERTERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Heat Exchangers and Converters, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Design standards: ASME and Standard of Tubular Exchanger Manufacturers Association.

B. Factory test: Test sheets and tubes at 300 PSI.

1.3 SUBMITTALS

A. Product Data:

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.
   3. Test reports.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Heat exchangers, shell and tube:
   1. Base:
      a. Bell & Gossett, ITT.
   2. Optional:
      a. Taco.
      b. Dunham-Bush.
      c. Patterson-Kelley.
      d. Adamson.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Heat exchangers: Instantaneous, shell and U-tube type, heating liquids with steam, with removable tube bundle.
   1. Capacity: As indicated, with steam in shell, water in tubes.
   2. Shell working pressure: 150 PSIG.
   3. Shell: Steel.
   4. Heads: Cast iron.
   5. Tubes: Copper, 3/4 IN OD minimum.
   6. Fouling factor: 0.001 on water and steam sides.
   7. Pressure loss in header coils: As indicated.
   8. Maximum tube velocity: 7.5 FPS.
   9. ASME code construction.
   10. Control: See Section 25 50 00.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install components in system piping as indicated.

B. Install so tube bundles may be removed without disturbing piping.

END OF SECTION

SECTION 23 73 23
FACTORY BUILT CUSTOM AIR HANDLING UNITS

PART 1 - GENERAL

1.1 SUMMARY

A. Description of system:
   1. Factory built, custom air handling units.

B. Work included:
   1. Furnish labor, materials, tools, equipment, rigging and services for units AHU-1, AHU-20A, and AHU-20B as indicated in accordance with provisions of Contract Documents.
   2. Completely coordinate with work of other trades.
   3. Although such work is not specifically indicated, provide supplementary or miscellaneous items, appurtenances and devices incidental to or necessary for a sound, secure and complete installation.

1.2 QUALITY ASSURANCE

A. Standards:
   1. ADC-1062R2, Air Diffusing Equipment Test Code.
   2. AMCA-210, Test Code for Air Moving Devices.
   3. ASHRAE-70-72, Method of Testing for Rating the Air Flow Performance of Outlets and Inlets.
   4. NFPA-90A Standard for the Installation of Air Conditioning and Ventilating Systems, 1993 edition.
   5. ARI-410-72, Forced-Circulation Air- Cooling and Air-Heating Coils.
   6. AMCA-99 - Standards Handbook.
   7. AMCA-204 – Methods and Standards for Fan Balancing.
   8. AMCA-210 - Laboratory Methods of Testing Fans for Rating Purposes.
   9. AMCA-300 - Test Code for Sound Rating Air Moving Devices.
   10. AMCA-301 - Method of Publishing Sound Ratings for Air Moving Devices.
   11. AMCA-500 - Test Methods for Louver, Dampers, and Shutters.
   12. ANSI/AFBMA-9 - Load Ratings and Fatigue Life for Ball Bearings.
   13. ANSI/AFBMA-11 - Load Ratings and Fatigue Life for Roller Bearings.
   14. ARI-410 - Forced-Circulating Air-Cooling and Air Handling Coils.
   15. ARI-430 - Standard for Central Station Air Handling Units.
   16. ARI-435 - Standard for Application of Central Station Air Handling Units.
   17. ASHRAE-62 - Ventilation for Acceptable Indoor Air Quality.
   18. UL-508 - Standard for Industrial Control Panels.
   19. UL-1995 - Standard for Safety - Heating and Cooling Equipment.

B. Construction standards and criteria:
   1. Unit Construction Pressure Class: 10 IN static pressure, positive and negative.

C. Minimum quality control requirements and performance:
   1. Factory balancing:
      a. Fan wheels and shaft assemblies shall be factory balanced both statically and dynamically to meet AMCA 204 standards for residual unbalance.
   2. Fan performance curves:
      a. Tests shall be conducted in a certified AMCA laboratory in accordance with current AMCA Standards.
   3. Leakage: No more than ½ percent of scheduled air handling unit cfm at 10 IN static pressure.

4. Panel deflection: No more than 1/240 of an inch.
5. Coils:
   a. Coils shall be factory tested to 325 PSI compressed air under clear water.
6. Air handling units shall be designed and manufactured in strict accordance with UL-1995, Standard for Heating and Cooling Equipment. All units shall be listed and shall bear the UL 1995 label.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Dimensional shop drawings.
      a. Show casing construction (base, floor, housing); access door hardware; operating weight (point and distributed loads).
   2. Filter frames.
   3. Fan/motor vibration isolation details.
   4. Field connection details.
   5. Required clearances.
   6. Predicted sound data at eight octive bands for each opening in the unit.

B. Product Data:
   1. Casing thermal performance.
   2. Fan data:
      a. Sound power levels based on fan arrangement in unit.
      b. Certified fan curves at following conditions:
         1) Scheduled operating conditions including initial and final as noted.
         2) 50 percent airflow operating condition (used to evaluate potential surge conditions).
      c. Computer selections based on schedule performance criteria.
      d. Motor electrical characteristics.
   3. Filters.
   4. Coil data:
      a. Computer selections of based on scheduled performance criteria.
   5. Dampers.
   6. Air Blenders.
   7. Humidifier.
   8. Sound attenuators.
      a. Certified test data on dynamic insertion loss, self-noise power levels, and aerodynamic performance for reverse and forward flow test conditions.
   9. Vibration isolation components.

C. Contract Closeout Information:
   1. Operating and maintenance data including:
      a. Bearing lubrication instructions.
      b. Filter replacement instructions.
      c. Motor and drive replacement instructions.
      d. Wiring diagrams.
   2. Owner instruction report.
   3. Factory certified pressure test report on cabinet casing.
      a. With access doors in place, test to 10.0 IN TSP:
         1) Report to factory certify air handling unit cfm leakage rate.
         2) Report to factory certify air handling unit panel deflection.
   4. Warranty.

1.4 WARRANTY

A. Provide full parts and labor manufacturer warranty to include all parts, labor, travel time, and incurred expenses. Warranty to cover from date of start up to date of substantial completion, plus an additional 24 month full parts and labor manufacturer warranty from date of substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Air handling units:
   1. Base:
      a. Huntair.

B. Filters:
   1. Base:
      a. American Air Filter.
   2. Optional:
      a. Eco-Air Products.
      b. Cam-Farr.
      c. Flanders.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Thermal Break Construction
   1. Unit shall be guaranteed not to form surface condensation under the following conditions:
      a. Mechanical space conditions of 84 degF dry bulb and 77 degF wet bulb.

B. Guarantee:
   1. AHU manufacturer shall provide written guarantee against condensation forming on the unit exterior at the above listed conditions. AHU manufacturer will cover all expenses associated with modifying units in the field should external condensation form on the unit(s).

C. Unit Base
   1. Air handling unit base:
      a. Material: Heavy duty structural steel channel; formed metal base structure is not permitted.
      b. Channels: Solid welded at connection points to assure rigidity.
         1) Perimeter channel: Sized to allow for rigging and handling.
      c. Base cross supports: Located and sized to support internal components.
         1) Internal supports: Properly spaced to avoid oil canning of unit floor above.
         2) Cope structural members that intersect with open side of channels or add filler piece to assure structural integrity.
      d. Equipment eight feet wide and wider: Provide with a means of supporting center of unit on a truck.
      e. Lifting lugs: Add to perimeter channel along longest length of unit or unit module.
         1) Position and/or extend each lug to avoid any obstruction which extends beyond unit casing, including piping vestibules, surface mounted electrical or control panels, piping connections, and other appurtenances affixed to the unit exterior housing.
         2) Incorporate into each lug a means of attaching a cable or chain.
      f. Split in maximum size pieces to allow for economical shipment to jobsite.
         1) Coordinate with installation conditions on site.
   2. Base drain pans:

a. Provide as integral part of unit base in following sections:
   1) Cooling coil section.
   2) Humidifier section.
   3) Outside air inlet and mixed air sections.
b. Double wall construction of type 304 stainless steel.
   1) Drain pan underliner: Type 304 stainless steel filled with insulation to provide a minimum R-7 insulation assembly.
      a) Underliner not required for foam insulation.
   2) Provide 2-1/2 IN wide, 12 gauge type 304 stainless steel inverted channels on a maximum of 24 IN centers to reinforce pan to support coils.
   3) Drain pans construction shall be fully welded.
c. Size:
   1) Minimum width: .
      a) Pitch in direction of air flow to assure water migration.
      b) Drain pan shall extend a minimum of 12 IN downstream of the cooling coil.
      c) Drain pan shall extend a minimum of 24 IN beyond the leaving side of the humidification elements.
      d) Drain pans in mixed air sections: Extend the width of the section.
      e) Drain pans in outside air inlet sections:
         (1) Top inlet: extend from the edge of the next upstream component to the edge of the next downstream component.
         (2) Back inlet: extend from the face of the inlet to the next downstream component but no less than 48 IN.
d. Clearances:
   1) Provide adequate clearance, but not less than 2 IN, between bottom of the inverted coil mounting channels and top of the drain pan to allow for visual inspection and cleaning of the drain pan without coil removal.
      a) Coil height, including the coil casing material, shall not extend into the drain pan height.
      b) Coil supports shall be arranged to allow the coil to be removed to one side of the air handling unit by removal of pipe connections and one cabinet wall panel and sliding the coil horizontally (above the drain pan height) on the coil supports.
e. Drain pan slope: Double or triple slope drain pan, minimum of one percent, and pitched toward drain connection side.
f. Provide drain connections on one side of unit where floor drain(s) are located.
   1) Construct drain lines of same material as pan.
   2) Extend drain lines through perimeter base channel and continuously weld seams/penetrations to insure an air-tight seal.
   3) Provide removable cap on each drain connection.

D. Unit Floor
   1. Air handling unit floor:
      a. Material:
         1) Minimum 12 gauge G90 galvanized steel.
         2) Space welds from below floor no greater than 4 IN on center.
         3) Space welds from top of floor no greater than 1-1/4 IN on center.
         4) Drive screw attachments are acceptable for floors with sprayed on foam insulation. However drain pan construction is fully welded.
      b. Floor construction: Double wall and constructed to meet L/240 deflection based upon 300 LB concentrated load at mid-span.
      c. For adequate support, provide a base structural member centered under edges of each sheet of flooring material.
         1) Seal floor seams with a continuous bead polyurethane sealant which meets ASTM-C920, Type S, Grade NS, Class 25 and is USDA approved, paintable and EPA approved for potable water contact.

2) Base supports above floor are not acceptable due to hazards to service personnel.

d. Overlap floor on perimeter base channel to allow a means of attaching cabinet panels from exterior without penetrating structural steel.

e. Lay floor flat and flush with top surface of base channel.

E. Unit Housing

1. Air handling unit housing:

a. Wall construction:

1) Double wall, panelized construction such that all internal components can be easily accessed for service or removal without removal or disassembly of any exterior wall sections or panels or roof sections or panels.

2) Material: G90 galvanized steel.

a) Minimum 20 gauge for foam insulation construction.

b) Minimum 16 gauge for fiberglass insulation construction.

3) Deflection: L/240 at static pressure equivalent to Unit Construction Pressure Class.

2. Supply and return openings:

a. For supply air, provide openings with rectangular, round, or oval wide radiused, bellmouth fittings and duct collars to accept supply and return air connections as indicated.

b. Provide removable G90 galvanized steel grating over floor openings inside of air handling unit.

1) Weight support: capable of supporting 300 pounds.

2) To avoid tripping hazard, grating shall be flush with the finished floor of the unit.

3. Unit split modules:

a. Provide necessary hardware to reassemble equipment such as bolts, nuts, washers, sealant, and slip cleats.

b. Mark each corresponding module of cabinet with matching letters to assist in reassembly.

4. View windows: provided in access doors.

a. View window frame: Fabricated from 16 gauge galvanized steel.

b. Provide 3/4 IN thick thermopane wire glass window.

c. Seal window frame to cabinet with open cell gasket on sides to ensure an air tight seal.

d. Window open viewing size: 12 IN x 12 IN.

e. View windows at sections with UV lights (installed or noted for future install): Provide UV filtering glass.

F. Unit Insulation

1. Air handling unit insulation - general:

a. Meet NFPA-90A smoke and flame spread requirements.

b. Provide insulation materials with facings that will not promote microbial growth.

c. R-value of wall, roof and floor assemblies: minimum of R-12.

d. Type: Foam or fiberglass.

G. Unit Liners

1. Liners - general:

a. As a protective cover for insulation, provide liners on the interior of the air handling unit integral parts of the exterior panel system.

b. Consolidate internal reinforcing as well as interior lining surface into one piece.

1) Allow attachment of interior liner to cabinet without exposing any drive screws or bolts which can be hazardous to service personnel.

2) Provide a smooth, uninterrupted surface.

3) Exposed reinforcing is unacceptable due to impedance of air performance.

2. Solid liner:

a. Liner material: Minimum 20 gauge G-90 galvanized steel, except where specifically indicated otherwise.

b. Liner material in wetted sections: Minimum 20 gauge type 304 stainless steel.

1) Provide in following sections:

a) Cooling coil section.
b) Humidifier section.

c. Do not allow exposure of any insulation to air stream.
d. Fabricated from a solid sheet without any perforations.
e. Cover openings and corners to completely contain insulation.

H. Unit Finishes
1. Finishes:
a. Exterior finish: Wall and roof panels.
1) One coat of polyurethane primer and one coat of polyester-hybrid semi-gloss top coat.
a) Prime and top-coat panels on both sides. (Interior of the unit is not painted.)
b) Color: Manufacturer's standard.
c) Paint system shall pass a minimum of 1000 hour salt spray test per ASTM-B117.
b. Base finish:
1) Same as base finish, or:
a) Paint with alkyd enamel.
(1) Provide industrial grade alkyd enamel red oxide primer by air brush to 2 mils thickness.
(2) Provide alkyd enamel top coat with air brush to 2-3 mills thickness.
b) Color: Manufacturer's standard.
c. Fan assembly finish:
1) One coat of polyurethane primer and one coat of polyester-hybrid semi-gloss top coat.
a) Prime and top-coat panels on both sides.
b) Color: Manufacturer's standard.
c) Paint system shall pass a minimum of 1000 hour salt spray test per ASTM-B117.
2) Aluminum fans shall not require paint finish.
d. Interior finish: Paint non-galvanized or welded surfaces with red oxide primer and machinery gray enamel.

I. Fan Assembly
1. Fans - general:
a. Performance ratings: rated in accordance with laboratory tests conducted in accordance with AMCA Standard 210.
b. Ratings: As indicated.
c. Arrangement: As indicated
d. Drive sheaves: Cast iron with split taper bushings dynamically balanced at factory.
1) Provide wide range variable speed, adjustable sheaves to be used for balancing systems.
e. Provide final fixed pitch drive sheaves for proper RPM determined during balancing process.
2. Fanwall Technology (Plurality of fan arrangements):
a. General:
1) The Fan Wall Array, shall consist of:
a) Multiple direct driven, arrangement 4 plenum fans constructed per AMCA requirements for duty specified, (Class I, II, or III).
b) Multiple fan/motor "cells", spaced in the air way tunnel to provide a uniform air flow and velocity profile across the entire air way tunnel cross section and components contained therein.
2) All fans shall be selected to deliver design air flow at the specified operating TSP (Total Static Pressure) at the specified motor speed as scheduled.

3) The fan array shall be selected to operate at a system TSP that does not exceed 90% of the specified fan's peak static pressure producing capability at the specified fan speed.

b. Performance:
   1) The fan array shall produce a uniform air flow profile and velocity not to exceed the specified cooling coil and filter bank face velocity when measured at a point 12 IN from the intake side of the Fan Wall array septum wall, and a distance of 42 IN from the discharge side of the Fan Wall array septum wall.
   2) Fan shall be structurally designed to withstand the maximum motor RPM at 60 hertz.
   3) The fanwall array shall be installed such that the optimum system operating efficiency may be achieved by manually, or automatically, enabling or disabling fans in the array to provide the minimum connected HP for the Fan Wall array that is necessary to produce the required air flow and pressure in the system. The Fan Wall shall be configured such that the connected HP at reduced flow conditions may be less than the installed total HP of the Fan Wall array in order to achieve optimum system efficiency. Each fan in the array shall be individually wired to its own dedicated individual VFD and wired to a control panel controlling all VFD's for the fan array.
   4) The Fan Wall Array shall be provided with acoustical silencers that reduce the bare fan discharge sound power levels by a minimum of 15 db re 10^-12 watts throughout the eight octave bands with center frequencies of 125, 250, 500, 1000, 2000, 4000, and 8000 HZ when compared to the same unit without the silencers. The silencers shall not increase the fan total static pressure, nor shall it increase the airway tunnel length of the Air Handling Unit when compared to the same FANWALL® unit without the silencer array.
      a) Alternate manufacturers must submit acoustical data for review and approval prior to the bid indicating that the proposed alternate equipment can meet all specified performance requirements without impacting the equipment performance or design features including duct connection location, unit weights, acoustical performance, or specified total fan HP for each fanwall array. Proposals submitted which indicate a higher connected fan HP than specified or scheduled will not be accepted.

c. Fan/motor cartridge:
   1) Each fan/motor cartridge shall consist of:
      a) Steel intake wall: 11 gauge A60 galvanized steel.
      b) Inlet funnel: 14 gauge spun steel.
      c) Motor support plate and structure: 11 gauge A60 galvanized steel.
      d) All components to be powder coated epoxy for enhanced corrosion resistance.
      e) Motors: See section 20 05 00.
         (1) Shall be selected by the manufacturer and suitable for array application.
      f) Each fan/motor cartridge shall be removable through a 30 IN wide, free area, access door located on the discharge side of the fan wall array.
   2) Each fan/motor cartridge shall be capable of being isolated from the array in the event of a fan failure. One of the following shall be provided to accomplish this isolation:
      a) Zero pressure drop air straightening manual backdraft dampers.

d. Balancing:
   1) Each fan array and assembly shall be dynamically balanced to meet the following requirements of AMCA standard 204:
      a) Category: BV-5.
      b) Grade: G 1.0.
      c) Residual unbalance: equal to or less than .0028 oz-in/lb of rotor mass.

e. Drives and wiring:

1) Each individual fan in the array to be equipped with a VFD (Refer to 25 23 00 for VFD requirements). All VFD's to be located in a single control cabinet. Provide one control cabinet for each return fan and supply fan array. Provide single point power connection to each fan array to power all VFD's for that array.
2) Wiring sizing shall be determined in accordance with NEC standards.

f. Safety screens at fan discharge: Provide on all fanwall array discharge modules.

g. Sound Pressure Levels:
1) Unit inlet and outlet discharge sound pressure levels and radiated sound pressure levels shall not exceed the values scheduled for the or alternate single direct drive plenum fan.

3. Air flow measuring stations: Comply with Section 25 50 00.
a. Factory install air flow measuring stations in the inlets of the supply and return fans. For units with dual supply and dual return fans, mount stations such that the fan blank off panels can be mounted so they do not disturb air flow station.
b. Inlet venturi cone/ring may be used with airflow station transmitter as specified in Section 25 50 00.
1) Device shall meet or exceed airflow station requirements identified in Section 25 50 00.
c. Transmitters specified in Section 25 50 00 may be field or factory installed.

4. Active Noise Cancellation
a. The fanwall array shall be provided with coplanar acoustical silencers around the fans for discharge sound attenuation and active noise control on the inlet of each individual fan in the fan array.
b. Active noise control shall create zero pressure drop on the system.
c. Provide with low-voltage controller (24 Vdc) that contains microcomputer hardware and advanced adaptive signal processing software used to generate inverse sound waves which destructively interfere with the propagating noise.
d. Provide the latest Active Noise Cancellation Technology at the time of manufacturing the air handling unit.

J. Economizer
1. Economizer section includes:
a. Dampers and linkage for return air, outside air, and exhaust/relief air.
b. Drain pan.

2. Dampers, control:
a. Provide control dampers for return, outside and exhaust/relief air.
1) Control dampers: As specified in Section 23 31 13, factory mounted.
2) Damper actuators: As specified in Section 25 50 00, field or factory mounted.
3) Size dampers with 1500 to 1800 FPM air velocity.
4) Outside and return air dampers: Parallel blades arranged to provide convergent airflow to minimize stratification.

3. Drain pan: double sloped to assure positive condensate drainage with connections on one side located adjacent to floor drain. The pan shall be of double wall construction with a stainless steel liner and have a minimum of 2 IN of insulation (uncompressed). The pan shall have a minimum depth (free-board) of 2 IN.

K. Air Blenders
1. Air Blenders: As specified in Section 23 31 13. Air blenders in unit shall be factory installed with sufficient distance downstream of air blender to allow for proper mixing and uniform mixed air temperature.

L. Filter Banks
1. Filter banks (filter frames with filters) - General:
a. Factory fabricate as part of air handling unit.
b. Mount filter bank in air handling unit.
1) Continuously bond periphery of filter frame to inside of air handling unit to eliminate air bypass.

2. Filter frames - General:
    a. Provide frames compatible with filters scheduled.
    b. 16 gage galvanized steel.
    c. Equip frame with protective diagonal support members on both air entering and air exiting sides of filters.
    d. Equip frame with gaskets and heavy-duty, positive-sealing fasteners capable of being attached or removed without use of tools.
    e. Filters shall be accessible from inside the unit.
3. Filters:
    a. Capacities and types: As scheduled.
    b. Locations: As scheduled.
    c. UL Class 2 listed.
    d. Provide quantities and standard sizes to match requirements of air handling unit.
    e. Provide two sets of pre-filters and final filters.
4. Pre-filters: Extended surface panel type.
    a. Provide two sets of prefilters.
    b. Average media efficiency: As scheduled.
        1) Efficiency is based on ASHRAE Test Standard 52.1.
    c. Double-wall, moisture-resistant beverage-board frame.
    d. Adhere media pack to interior of frame at points of contact (sides, entering face, and leaving face).
    e. Pleat support grid: Welded wire or expanded metal.
5. Final filters:
    a. Filters: Rigid cartridge type.
        1) High performance, deep pleated, totally rigid and totally disposable type with high density microfine glass fiber media, media support grid, contour stabilizers and enclosing frame.
        2) Average media efficiency: As scheduled.
            a) Efficiency is based on ASHRAE Test Standard 52.1.
        3) Filters arranged for face loading into positive sealing "type 8" filter frames.
        4) Constructed by pleating a continuous sheet of moisture-resistant water-laid micro-fine glass media into closely spaced pleats with hemmed-edge corrugated aluminum separators.
        5) Sealed into a 24 gauge galvanized steel frame with fire-retardant potted urethane elastomer sealant.
        6) Frame:
            a) Enclosing frame: Assembled in a rigid manner and incorporate a single or double header as required for job conditions.
            b) Headers: Gasketed with polyfoam on vertical sides to prevent leakage when installed in framing modules.
6. For each individual filter bank, provide Dwyer Series 2000 magnahelic filter gauges, with adjustable signal flag and sun shield enclosure for outdoor units.
7. Provide walk-in filter access sections upstream of filter rack with adequate space available for filter service.

M. Coils
1. Coils - general:
    a. Certified in accord with ARI 410.
    b. Coil capacity, size and type: As scheduled.
    c. Arrange coils for easy removal.
    d. Coil support rack:
        1) Mount coils on support rack.
        2) For stacked coils, lower coil sections shall be capable of being removed without disturbing upper coil sections.
        3) Rack construction:
            a) Heating coils: 16 gauge G90 galvanized steel

b) Cooling coils: 16 gauge 304 stainless steel.

e. Blank off coil ends to ensure air passes through the coils.
   1) Heating coils: 12 gauge G90 galvanized steel
   2) Cooling coils: 12 gauge 304 stainless steel.

f. Working Pressure Rating:
   1) Water coils: 250 PSIG.
   2) Steam coils: 50 PSIG.

g. Temperature Rating: 300 deg F.

h. Coil Connections:
   1) Threaded connections located on same end, except where otherwise noted or shown.
   2) Coil headers, distributors and connections completely enclosed in unit casing.
   3) Water coil vent and drain connections:
      a) Provide for each section.
      b) Extend all vents and drain lines to the exterior of the unit housing.
      c) Locate on the same side of the unit as the supply and return piping.
      d) Interior manifolding of individual coil drain and vent lines, prior to extending to the unit exterior is not acceptable.

2. Water Heating Coils:
   a. 5/8 IN OD copper tubes, 0.025 IN wall; 0.035 IN wall on return bends.
   b. Minimum 0.0075 IN thick aluminum fins, spiral or plate fin design.
      1) The maximum fin spacing shall be 10 FPI.
   c. 16 gauge G90 galvanized steel casing.
   d. Non-ferrous, copper headers.

3. Chilled Water Cooling Coils:
   a. 5/8 IN OD copper tubes, 0.025 IN wall; 0.035 IN wall on return bends.
   b. Minimum 0.0075 IN thick aluminum fins, plate fin design.
      1) The maximum fin spacing shall be 10 FPI.
   c. 16 gauge type 304 stainless steel casing.
   d. Non-ferrous, copper headers.

4. Intermediate condensate drain pans:
   a. On stacked cooling coils, provide intermediate pan to prevent condensate from upper coil(s) from passing over lower coil(s).
   b. Intermediate drain pans shall be insulated with 1 IN elastomeric insulation on the underside to prevent condensation formation and moisture carry-over due to adiabatic condensation formation on the intermediate drain pans.
   c. Fabricated from same material and in same style as base drain pan.
   d. Provide 1 IN diameter, 304 SS or copper down spouts from upper pan(s) to lower pan(s).

N. Humidifiers
   1. Steam humidifier: Steam distributing header type humidifier to be installed as shown. Humidifier manifolds shall be factory mounted and installed.
      a. Comply with Section 23 84 13.
      b. Humidifier to be suitable for inlet pressures as indicated.
      c. Provide the following connections in casing cabinet:
         1) Jacket steam connection.
         2) Main steam connection for interior steam distribution header.
         3) Header drip connection.
         4) Jacket drip connection.
      d. The plain steel surfaces of the interior steam distribution header shall be epoxy coated. Spec note.

O. UV lights
   1. UV light bar wiring to comply with NEC requirements and conform with applicable U/L standards and Electrical Specification Divisions.

2. Each UV bar shall be wired and tested at the factory before shipment.
3. Fixtures:
   a. Tested by an independent regulatory agency (ETL or UL).
   b. Listed and labeled showing compliance with all UL/CUL standards included in Category Code ABQK (Accessories, Air Duct Mounted), including UL Standards: 153, 1598 & 1995 respectively.
4. Lamps:
   a. Each lamp shall contain no more than 8 milligrams of mercury.
   b. Produce the specified output at 500 fpm in temperatures of 55-135° F.
   c. Minimum useful lamp life: 9000 hours with no more than a 20% loss of UVC output at the end of one years of continuous use.
   d. Constructed with UVC proof bases and shall not produce ozone.
5. Irradiation:
   a. Average minimum radiation: 150 microwatts per square centimeter.

P. Access Doors
1. Access doors: Hinged, double wall, insulated, thermal break type.
   a. Provide in following sections:
      1) Fan sections.
      2) Access sections.
      3) Filter sections.
      4) Humidifier section.
      5) Supply and return plenums.
      6) Section(s) where damper(s) are located (such as economizer section).
   b. Provide additional access doors where shown on drawings.
   c. Door construction:
      1) Door size, minimum: 24 IN wide x 72 IN high.
      2) Size door(s) to accommodate removal of following equipment through the door(s):
         a) Motors.
         b) Humidifier manifold.
         c) Heating and cooling coils.
      3) Exterior door skin: Same material and finish as unit housing.
      4) Door interior liner: Same material and finish as interior liner of section in which door is installed.
      5) Access door perimeter: One piece, welded.
      6) Insulation: Same as unit wall insulation.
   d. Door frame: One piece, welded.
   e. Gasketing:
      1) Provide full circumference gasketing with a closed cell, replaceable neoprene gasket.
      2) Provide gasketing system that allows for easy removal for replacement.
      3) Provide system that will maintain a tight seal without assistance of operating pressure.
   f. Hinges and latches:
      1) Provide corrosion resistant, fully adjustable hinges and latches to allow for maintenance of a tight seal between door and unit as gasketing material compresses over time.
      2) Provide stainless steel, removable hinge pins to allow door to be easily removed during servicing.
      3) Leaf and Piano type hinges are not acceptable.
      4) Provide for padlocking of latches to fan sections.
      5) Latch and paw assemblies: One piece, bolted together.
   g. Hinge access doors so they open against unit operating pressure unless otherwise indicated.

Q. Safety devices:

1. Access to sections where Ultraviolet Light (UV) may pose a risk for direct exposure:
    a. Provide mechanical interlock switch that disconnects power to the lights when the door or access panel is opened.
    b. Provide an externally mounted on-off/disconnect/shut off switch that disconnects power to the UV lights. The switch shall be equipped with a lock-out/tag-out to prevent unwanted operation of the UV lights.
    c. View windows. Provide view windows that are treated and tested to assure the UV energy emitted through the window is below the threshold limits specified by NIOSH and ACGIH.
    d. Safety warning label applied to the door.

R. Pressure Relief Doors
1. Pressure relief doors: Provide vertically mounted pressure relief doors in the supply air plenum and the return air plenum.
    a. Quantity: As indicated.
    b. Frame: 12 GA galvanized steel, Z shaped.
    c. Door: 12 GA galvanized steel.
    d. Seal: Polyurethane foam around door perimeter.
    e. Pressure setting for all AHU's
        1) Supply plenum: 4 IN WG positive.
        2) Return plenum: 4 IN WG negative.
    f. Springs: Negator type for door closure upon loss of over pressurization.
    g. Size: 18 IN x 18 IN.
    h. Insulation: For the supply plenum pressure relief, provide 1 IN thick foil faced insulation on the inside surface.
    i. Comply with Section 23 31 13.

S. Electrical
1. Wiring to comply with NEC requirements and conform with applicable U/L standards and Electrical Specification Divisions.
2. Each unit shall be wired and tested at the factory before shipment.
3. Provide separate factory wired branch circuits for each supply and return air fan motors. Terminate with junction boxes at unit exterior.
4. Lights:
    a. Provide one factory installed light for each air handling section which has an access door.
    b. Fixture: LED marine type.
    c. There shall be a minimum of two light switches per air handling unit with each light switch controlling half of the lights. Light switches shall be mounted external of the units and shall have a pilot light. Exterior units shall have weatherproof switch.
    d. Provide a separate 120 volt factory wired circuit for unit lights. Terminate circuit at junction box at unit's exterior.
    e. At shipping sections, provide additional junction boxes on each module to allow the installer to make final connections in the field.
        1) Clearly label wiring to ease final interconnections.
5. Outlets:
    a. Rounding up to the next highest number, provide a minimum of one factory installed double grounded GFCI receptacle per 15 foot of air handling unit length (For example, a 43 foot long unit would require 3 receptacles.). Exterior units shall have weatherproof receptacles.
    b. Provide a separate 120 volt factory wired circuit for unit receptacles. Terminate circuit at junction box at unit's exterior.
    c. At shipping sections, provide additional junction boxes on each module to allow the installer to make final connections in the field.
        1) Clearly label wiring to ease final interconnections.

2.3 VIBRATION ISOLATION

A. Vibration isolation: See Section 20 05 50.

2.4 UNIT TESTING

A. General: Factory air leakage and panel deflection tests shall be conducted under the supervision of the AHU manufacturer. The AHU manufacturer shall repair/replace at his own expense any items that fail or are damaged during testing. For any unit that fails testing, the AHU manufacturer shall retest the unit until all items are in compliance with limits specified herein.

B. Air leakage: Factory pressure test unit to positive and negative 10 IN WG and eliminate all noisy leaks. Leakage shall not exceed 1/2 percent of unit design airflow volume. Submit test report.

C. Panel deflection test:
   1. Panel deflection checks shall be done in conjunction with and at pressures stated in pressure leak test.
   2. Once unit is leak tested and determined to be acceptable, a panel deflection test may be conducted. Deflection will be measured at four (4) points around the cabinet. Each point will be located at the largest unsupported span for the side. A dial micrometer will be placed against panel seam at the mid-point of the panel height. The cabinet will be pressurized to the specified static load and the deflection will be measured.
   3. Pass/Fail criteria will be based on 1/240 of the panel span as a maximum allowable deflection at specified static load.
   4. Submit test report within 30 days of test completion.

D. The above test described in Paragraph "A", "B", and “C” shall be performed at the manufacturer's facility prior to shipment.

E. The Owner/Architect shall be given the option to witness the tests at their own expense.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Field assemble air handling unit modules in accordance with manufacturer's installation drawings and instructions.
   1. Assemble unit complete with vibration isolation components.
   2. Sealing and fastening hardware shall be supplied by air handling unit manufacturer.
   3. Pour concrete for fan inertia bases.
   4. Provide lamps for lights.

B. Touch-up abraded or damaged finish.

C. Provide a trap on drains at jobsite on exterior of unit.
   1. Traps shall be adequate to maintain a water seal while equipment is in operation

D. Coordinate with Section 25 50 00 for location of water valves, temperature sensors, and damper operators.

E. Install final fixed sheaves furnished by air handling manufacturer.

F. Provide fan dynamic balancing services as specified in Section 23 35 00.

3.2 START-UP

A. Provide services of factory trained service technician to inspect units after erection, perform minimum 16 hour startup service and perform concurrent Owner instruction. File written report and include in maintenance manual.
   1. Coordinate startup with Test and Balance provider and Temperature Controls provider.

B. Equipment startup:
   1. Unit start-up to take place at completion of future Fit-up package work.
   2. Prior to the engineer's scheduled startup, complete the following:
      a. Ensure automatic temperature controls work is complete.
      b. Turn on power, and "bump" unit motors to verify correct fan rotation.
      c. Remove shipping materials.
      d. Ensure that spring isolated components are off shipping supports.
      e. Level spring isolated components.
      f. Install filtration media in equipment.
         1) Replace filters used in construction.
      g. Complete piping and duct connections.
         1) Complete leak checks on water piping prior to startup.
      h. On multiple piece units, complete interconnections (electrical, piping and ductwork) and roof joints.
      i. Make startup requests to manufacturer two weeks prior to scheduled date.
   3. Temperature control and air balance providers shall be on site at time of equipment startup.

END OF SECTION

SECTION 23 84 13
HUMIDIFIERS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Humidifiers, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Product Data:

B. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Humidifiers:
   1. Steam grid humidifiers:
      a. Base:
         1) Dri-Steem.
      b. Optional:
         1) Armstrong International
         2) Pure Steam.
         3) Hygromatik, Spirax Sarco.
         4) Herrmidifier.
   2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Humidifiers: Stainless steel steam grid type:
   1. All parts in contact with steam or condensate shall be 304 grade stainless steel.
   2. Control and humidistat as specified in Section 25 50 00.
   3. The stainless steel steam control valve shall be able to control steam flow from maximum to minimum rangeability of 30:1.
   4. A steam separating chamber with baffles and mesh packing shall be provided to remove moisture particles larger than 3 microns.
   5. Temperature switch to prevent steam flow until unit is up to operating temperature.
   6. The stainless steel steam distribution manifold shall be designed for fast absorption. All vapor shall be fully absorbed by the air stream within 3 feet of the manifold at the normal operating condition of the system based on air temperature, velocity and relative humidity.
   7. Stainless steel y-strainer and steam trap. Trap manifold grid and steam separator separately when required by design.
   8. Capacity and performance as scheduled.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

END OF SECTION

DIVISION 25

INTEGRATED AUTOMATION

SECTION 25 23 00
VARIABLE FREQUENCY DRIVES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Variable Frequency Drives, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Manufacturer shall have a minimum of 7 years in manufacture and operation of PWM drives in size(s) indicated.

B. UL and or Electrical Testing Laboratories listed and labeled.

C. Tested to ANSI/UL-508A.

D. Plenum rated applications: Tested to ANSI/UL-508C.

E. Meet requirements of IEEE Standard 519, latest edition, "Guide for Harmonic Control and Reactive Compensation of Static Power Converters".

F. Local service representative's qualifications:
   1. Provide and maintain field service personnel authorized by Manufacturer to perform service both in and out of warranty.
   2. Maintain full stock of service parts for all units furnished.
   3. Provide in-depth training in operation of all units.

G. Manufacturers to ISO 9000 certified.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Dimensional drawings.
   2. Power circuit drawings.
   3. Control connection drawings.

B. Product Data:
   1. VFD's maximum rated output amps.

C. Project Information:
   1. Factory test reports.

D. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.
   3. Factory start-up and field test reports.
   4. Warranty.

1.4 WARRANTY

A. Warranty:
   1. 12 months from date of start up, not to exceed 18 months from date of shipment.
      a. Include all parts, labor, travel time and expenses.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Variable frequency drives, pulse width modulated:
   1. Base:
      a. Asea Brown Boveri.
   2. Optional:
      a. Yaskawa.
      b. Rockwell Automation.
      c. Danfoss-Graham.
      d. Square D.

B. Fuses:
   1. Base:
      a. Bussmann.
      b. Shawmut.
      c. Rockwell Automation.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. General:
   1. Variable frequency drives (VFD): Provided with full wave inverters (rectifiers) to convert three-phase, 60 Hz AC power to DC power, and inverters to "invert" DC power back to a variable frequency, three-phase AC power.
      a. Line side input terminals: 60 Hz AC, 3-phase, fused and provided by VFD manufacturer.
         1) Provide fast-acting semiconductor type, Class T, fuses, 200,000 AIC RMS.
   2. Inverter section: Pulse width modulated voltage source inverter (PWM).
      a. Variable voltage and variable frequency using insulated gate bipolar transistors (IGBT).
   3. Convert section: Full wave diode bridge rectifier or SCR type rectifier.
      a. SCR type units shall not be phase controlled.
   4. DC bus linking converter and inverter.
   5. General requirement for variable frequency drives:
      a. Variable frequency in proportion to output speed.
      b. Variable output voltage with constant volts/Hz over a variable torque output range.
      c. Supply full rated current at frequency within a variable torque output range.
      d. Develop full shaft power needed.
   6. Verify variable frequency drives are checked against each motor's total amperage.
   7. Total harmonic distortion on voltage waveform: Not to exceed 5 percent per IEEE 519 at point of common coupling.
   8. Drives shall have RFI/EMI filters.
   9. Minimum output frequency at full rated output amperage: 4 kHz.

B. Variable Frequency Drives (VFD's):
   1. Variable frequency drives (VFD's): Solid state, with a pulse width modulated (PWM) output waveform.
      a. VVI, six-step, and current source drives are not acceptable.
      b. Enclosures:
         1) As a minimum, the following closure types are to be used unless noted otherwise on plans:
            a) General purpose such as locations within mechanical rooms: NEMA 1.
            b) Outdoors: NEMA 3R.
         2) Use the following closure types where specifically indicated on plans:
            a) Dusty or corrosive atmospheres: NEMA 12 or better; sealed, non-ventilated, airtight.

b) High ambient temperature environments: NEMA 12 enclosure with air conditioner option.

3) Enclosure, including accessories, to be completely assembled and tested or all components provided in a single factory supplied racking system with components and accessories assembled, wired and factory tested.

c. Employ full wave rectifier designed to prevent line notching.

1) Drives 7.5 hp and greater:

a) Provide AC line or DC bus reactors.

(1) Minimum impedance: 5 percent impedance.

2) GTO's are not acceptable.

d. Drive efficiency: 97 percent or greater at full speed and full load.

e. Displacement power factor: 0.98 at all speeds and loads.

2. Printed circuit boards: Completely tested and burned-in before being assembled into completed variable frequency drive.

a. Subject variable frequency drive to a preliminary functional test, eight hour burn-in, and computerized final test.

b. Burn-in shall be at 104 degF, at full rated load, or cycled load.

c. Drive input power: Continuously cycled for maximum stress and thermal variation.

3. Environmental operating conditions:

a. 32 to 104 degF at 4kHz switching frequency.

b. 0 to 3300 feet above sea level, less than 95 percent humidity, non-condensing.

c. Atmosphere: Standard equipment room environment.

4. Additional requirements:

a. Provide same control interface and connections regardless of horsepower rating.

b. On loss of input signal:

1) Display a fault condition.

2) Maintain last output speed prior to loss of signal.

c. Utilize digital display (LCD or LED).

d. Automatically restart after an overcurrent, overvoltage, under-voltage, loss of input signal protective trip or any other fault.

1) Number of restart attempts and trial time to be programmable.

e. Capable of starting into a rotating load (forward or reverse) and accelerate or decelerate to setpoint without safety tripping or component damage.

f. Provide an automatic extended power loss ride-through circuit which will utilize inertia of load to keep drive powered.

1) Minimum power loss ride-through: One-cycle or extended time.

g. Control terminal strip: Isolated from line and ground.

h. Provide prewired 3-position Hand-Off-Auto switch, manual speed adjustment (keypad or potentiometer) and local-remote switch to control VFD.

1) When in "Hand" position, VFD will be started.

2) When in "Off" position, VFD will be stopped.

3) When in "Auto" position, VFD will start via an external contact closure.

4) When local-remote switch is in "Local" position, speed will be controlled by manual speed.

5) When local-remote switch is in "Remote" position, speed will be controlled by external speed reference.

6) Operate local-remote switch independently of HOA switch for maximum flexibility.

a) Control speed by manual speed adjustment or external speed reference by selecting "Local" or "Remote" regardless of whether HOA is in "Hand" or "Auto" position.

5. Provide following adjustments:

a. A minimum of 3 critical frequency lockout ranges to prevent variable frequency drive from continuously operating at an unstable speed.

1) Width of each frequency range: Field adjustable.

b. Two programmable analog inputs: Accept a current or voltage signal for speed reference, or for reference and actual signals for PI controller.
   1) Minimum and maximum values (gain and offset): Adjustable within range of 0-20 mA and 0-10 Volts.
c. Programmable analog outputs: Proportional to frequency, motor speed, output voltage, output current, motor torque, motor power, or DC bus voltage.
d. Relay outputs:
   1) Rated for maximum switching current 8 amps at 24 VDC and 0.4 amps at 250 VAC; Maximum voltage 300 VDC and 250 VAC; Continuous current rating 2 amps RMS.
e. Independently adjustable accelerate and decelerate rates (1-600 seconds).
f. Ramp or coast to a stop, as selected by user.

6. Operational information display will list the following as a minimum:
   a. Output Frequency.
   b. Motor current.
   c. Output voltage.
7. Protection circuits: In case of a protective trip, stop drive and display fault condition.
   a. Overcurrent trip: 200 percent of VFD's variable torque current rating.
   b. Overvoltage trip: 130 percent of VFD's rated voltage.
   c. Undervoltage trip: 60 percent of VFD's rated voltage.
   d. Overtemperature: Plus 158 degF.
   e. Adaptable electronic motor overload protection:
      1) Protect motor based on speed, load curve, and external fan parameter.
      2) Circuits which are not speed dependent are unacceptable.
8. Speed command input:
   a. Keypad or manual speed potentiometer.
   b. Analog inputs: Each capable of accepting a 0-20 mA 4-20 mA, 0-10 V, 2-10 V signal.
      a) Input: Isolated from ground, and programmable via keypad for different uses.
      b) Provide programmable filter to remove any oscillation of the reference signal.
      c) Able to be inverted, so that minimum reference corresponds to maximum speed, and maximum reference corresponds to minimum speed.
      d) Minimum and maximum values (gain and offset): Adjustable within range of 0-20 mA and 0-10 Volts.
   c. Pneumatic speed reference, 3-15 PSI: Via direct connection to adjustable frequency drive, without use of external pressure to electrical transducers.
      1) Provide a connector outside adjustable frequency drive enclosure for connection of pneumatic tubing.
9. Accessories:
   a. Interlock terminal strip:
      1) Provide separate terminal strip for connection of freeze, fire, smoke contacts, and external start command.
      2) External interlocks and start/stop contacts: Remain fully functional whether drive is in Hand, Auto or Bypass.
   b. All wires to be individually numbered at both ends for ease of troubleshooting.
   c. Door interlocked magnetic circuit breaker: Disconnect all input power from drive and all internally mounted options.
      1) Disconnect handle: Thru-the-door type, padlockable in "Off" position.
   d. The VFD shall be supplied with RS-485 interface and integration card compatible with Building Management and Control System.
      1) Coordinate with Section 25 50 00.

C. Factory startup test:
   1. Provide a certified factory start-up for each drive by factory authorized service center.
      a. Certified start-up form: Filled out for each drive with a copy provided to Owner, and a copy kept on file at Manufacturer.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's installation instructions and as specified.

B. Install free standing units on 4 IN housekeeping pads.

C. Install wall mounted units to room walls, or on free standing pedestals.

D. Cover and protect units from installation dust and contamination until environment is cleaned and ready for operation.

3.2 TESTING AND START UP

A. Field start up and testing:
   1. Provide services of a factory trained representative at site to supervise installation and startup.
   2. Test machines under operation through full speed range and record data at full load, 75 percent load, 50 percent load and 25 percent load, for a minimum of 1 hour at each load.
   3. Field test according to ANSI Standards.
   4. Start-up tech shall ensure drives are clean, trouble free and lugs tightened and electrical connections torqued per manufacturers recommendations.

3.3 OWNER INSTRUCTIONS

A. Provide services of manufacturer's representative for 8 hours to instruct Owner's operating personnel.
   1. Instruction hours shall be in addition to testing and startup hours.

B. Schedule this period when equipment is completely installed and tested and can be operated under normal load.

C. Provide instruction on each system type.

END OF SECTION

SECTION 25 50 00
BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SUMMARY

A. Provide Building Management and Control System (BMCS) incorporating Direct Digital Control (DDC), energy management and equipment monitoring consisting of the following elements:
   1. Microprocessor based remote control panels interfacing directly with sensors, actuators, and environmental delivery systems to provide complete standalone DDC/EMS functionality. (i.e., HVAC equipment, etc.).
   2. Communication network to allow data exchange between remote panels and central building management computer.
   3. Personal computer (PC) based central and associated operator station(s), and software functioning as the primary operator interface for BMCS. System shall utilize a graphics front end.
   4. Pneumatic, electric and electronic control for all items indicated including dampers, valves, panels and pneumatic and electrical installation.

B. Air terminal unit damper operators and controls: Provide DDC controllers and actuators under this section.

C. Smoke and fire/smoke dampers and operators are provided under Specification Section 23 31 13. Power connection to smoke and fire/smoke dampers shall be provided under Electrical Specification Divisions. Damper end switches shall be provided and wired under this section.

D. Control dampers: Control dampers less actuators are provided under Section 23 31 13. Provide actuators for control dampers under this section.

E. Duct mounted smoke detectors are to be furnished and wired under Electrical Specification Divisions. The detectors shall be mounted in compliance with Section 23 31 13.

F. Provide submittals, installation, data entry, programming, startup, test and validation of BMCS, instruction of Owner's representative on maintenance and operation of BMCS, as-built documentation, and system warranty.

G. Completely coordinate with work of other trades.

1.2 WORK BY OTHERS

A. Setting in place of valves, flow meters, water pressure and differential taps, flow switches, thermal wells, dampers, air flow stations, and current transformers.

1.3 QUALITY ASSURANCE

A. System to be installed by competent mechanics, with full responsibility for proper operation of BMCS, including debugging and proper calibration of each component in entire system.

B. Codes and approvals:
   1. Complete BMCS installation to be in strict accordance with national and local electrical codes, and Electrical Specification Divisions of these specifications. All devices designed for or used in line voltage applications to be UL listed.
   2. All microprocessor based remote devices: UL916 and UL864 listed.
   3. All BMCS central equipment: UL916 listed.
   4. All electrical environmental control and monitoring devices: UL429 and/or UL873 listed.

5. Following current UL standards are applicable UL429 Electrically Operated Valves UL555 Fire Dampers UL873 Temperature Indicating and Regulating Equipment UL916 Energy Management Equipment.
6. Following current NFPA Standards and Guides are applicable: NFPA-70 National Electric Code NFPA-90A Air Conditioning Systems NFPA-90B Warm Air Heating, Air Conditioning.
7. All electronic equipment shall conform to the requirements of FCC regulation Part 15, Section 15 governing radio frequency electromagnetic interference for Class A computing devices and shall be so labeled.

C. All system components shall be fault tolerant.
1. Provide satisfactory operation without damage at 110 percent and 85 percent of rated voltage, and at +/- 3 hertz variation in line frequency.
2. Provide static, transient, short circuit, and surge protection on all inputs and outputs. Communication lines to be protected against incorrect wiring, static transients, and induced magnetic interference. Bus connected devices to be a.c. coupled, or equivalent so that any single device failure will not disrupt or halt bus communication.
3. All real time clocks and data file RAM to be battery or capacitor backed.

D. System overall reliability requirement: The system, including all components and appurtenances, shall be configured and installed to yield a Mean Time Between Failure (MTBF) at least 1000 hours.

E. System accuracy and display: The system shall maintain an end-to-end accuracy for 1 year from sensor to Operator's console display for the applications specified and shall display the value as specified.

F. All field equipment shall be rated for continuous operation under ambient environmental conditions of 35 to 120 degF dry bulb and 10 to 95 percent relative humidity, non-condensing. Instrumentation and control elements shall be rated for continuous operation under the ambient environmental temperature, pressure, humidity and vibration conditions specified or normally encountered for the installed location.

1.4 SUBMITTALS

A. Shop Drawings:
1. Complete system design information including:
a. Data entry forms for initial parameters. All text and graphics to be approved prior to data entry.
b. Valve, and damper schedules showing:
1) Size.
2) Configuration.
3) Capacity.
4) Location.
c. Wiring and piping interconnection diagrams, including panel and device power and sources.
d. Equipment lists (bill of materials) of all proposed devices and equipment.
e. Software design data including:
1) Flow chart of each DDC program showing interrelationship between inputs, PID functions, all other functions, outputs, etc.
2) Sequence of operation relating to all flow chart functions.
f. Control sequence.
g. DDC installation, block diagrams, and wiring diagrams for each piece of equipment.
h. DDC panel physical layout and schematics.
i. Building level overview of control system architecture.

B. Product Data:
1. Complete list of product data including:
a. Data sheets of all products.

b. Valve, damper, and well and tap schedules showing size, configuration, capacity, and location of all equipment.

C. Project Information:
1. Certification of installer qualifications.

D. Contract Closeout Information:
1. Operating and maintenance manuals.
2. Owner instruction report.
3. Certification that Owner Training has been provided by BMCS installer.
4. As Built Instrumentation and Control Diagrams.
5. Plan As Builts at 1/8 inch scale showing:
a. Communication cable circuiting drawing with DDC panels and communication devices labeled.
b. Power wiring circuiting drawing showing 120 volt circuit source and low voltage transformer locations, identifications, and circuit roués to each controlled device per transformer for the DDC system.

1.5 WARRANTY

A. All components, system software, parts, and assemblies supplied by BMCS manufacturer to be guaranteed against defects in materials and workmanship for one year from acceptance date.

B. Labor to troubleshoot, repair, reprogram, or replace system components shall be furnished by BMCS installer at no charge to Owner during warranty period.

C. All corrective software modifications made during warranty service periods to be updated on all user documentation and on user and manufacturer archived software disks.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Temperature control system: The BMCS system shall be fully integrated either through the existing operator workstation with the existing I/NET system in compliance with the performance requirements set forth in this specification. All equipment provided herein shall be required to communicate through a facility wide BMCS workstation by means of full binary interface to maintain operations for courthouse personnel. Any additional software or hardware required to maintain the integrity of the existing facility wide system shall be included in the bid price. DDC hardware and software introduced as part of this project shall in no way alter the integrity of the existing facility wide system.
1. Temperature control system shall be as provided and installed by Control Masters contact Rick Sheer at (402) 333-9800 with Control Masters, Inc. 13326 "C" Street Omaha, NE 68144-3602.

B. Air flow monitoring stations:
1. Base:
a. Ebtron

C. Steam and chilled/heating water flow meters:
1. Base:
a. Onicon

D. Installer is responsible for quality and satisfactory operation of devices, and for overall performance of system.

E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Temperature control system:
   1. Include:
      a. Temperature sensors.
      b. Humidity sensors.
      c. Controllers.
      d. Switches.
      e. Relays.
      f. Valves.
      g. Dampers.
      h. Damper operators.
      i. Thermostats.
      j. Humidistats.
      k. Hygrometers.
      l. Other associated controls required to maintain conditions described in detail on drawings, together with thermometers, gauges and other accessory equipment.
   2. Provide complete system of wiring and air piping as necessary to fill intent of these specifications.
   3. Control sequences indicated illustrate basic control functions only.
   4. Provide additional controls required to meet intent of these specifications and make a complete system.
   5. Space temperature and humidity control.
   6. Control of air handling units.
   7. Control of exhaust systems.
   8. Control of cooling systems.
   9. Control of heating systems.
   10. Control panels.

B. Where electronic sensing is used, furnish amplifier relays and transformer complete with overload protection.

C. Electrical drawings indicate type of motor control required by equipment.

2.3 CENTRAL OPERATORS WORK STATION

A. Existing central operators work station shall be reused. All new direct digital controls shall interface with existing work station.

2.4 WEB BASED SYSTEM

A. BMCS Architecture
   1. Overall Conceptual Description
      a. The BMCS shall be designed entirely for use on intranets and internets. All networking technology used at the Tier 1 level shall be off the shelf, industry standard technology fully compatible with other owner provided networks in the facility.
      b. All aspects of the user interface, whether to servers or to Tier 1 solid state devices, shall be via browsers. Any PCs used as operator interface points shall not require the purchase of any special software from the manufacturer in order to provide the complete user interface as described herein.
      c. The user interface will be complete as described herein, providing complete tool sets, operational features, multi- panel displays, and other display features. Systems which merely provide HTML based web pages as the operator interface will not be acceptable.

d. The primary components of the system will be the Primary Application Nodes and Servers located at the highest level of the network architecture. Both will use the same user interface and provide the same level of accessibility via the network. The only distinction between the user interface used on servers as compared to Primary Application Nodes will be select menu items used for accessing long term storage features on the servers or on their respective archive devices (CD/RW, etc.)

2. General
   a. The BMCS shall consist of a number of Nodes and associated equipment connected by industry standard network practices. All communication between Nodes shall be by digital means only.
   b. The BMCS network shall at minimum comprise of the following:
      1) Operator PCs – fixed or portable.
      2) Network processing, data storage and communication equipment including file servers.
      3) Routers, bridges, switches, hubs, modems and like communications equipment.
      4) Active processing Nodes including field panels.
      5) Intelligent and addressable elements and end devices.
      6) Third-party equipment interfaces.
      7) Other components required for a complete and working BMCS.
   c. All BMCS features shall be accessible via Enterprise Intranet and Internet browser with equivalent BMCS access control for user access.
   d. The BMCS shall support auto-dial/auto-answer communications to allow BMCS Nodes to communicate with other remote BMCS Nodes via standard telephone lines. Refer to drawings for type of line to be used, DSL or voice grade. Where no preference is indicated, DSL is the preferred grade.
   e. The PC Workstations, File servers and principal network equipment shall be standard products of recognized major manufacturers available through normal PC vendor channels. "Clones" are not acceptable.
   f. Provide licenses for all software residing in the BMCS system and transfer these licenses to the Owner prior to completion.
3. Network
   a. The BMCS shall incorporate a primary Tier 1 network. At the installer's option, the BMCS may also incorporate integrated secondary Tier 2 and tertiary Tier 3 networks.
   b. The BMCS Network shall utilize an open architecture capable of all of the following:
      1) Utilizing standard Ethernet communications and operate at a minimum speed of 10/100 Mb/sec
      2) Connecting via BACnet at the Tier 1 level in accordance with as per ANSI/ASHRAE Standard 135-2001.
      3) Connecting via the N2 Protocol at the Tier 2 level.
      4) Connecting via LonMark as per ANSI/EIA 709 (LonWorks) to LonMark FTT-10 transceivers at the Tier 2 level.
   c. The BMCS network shall support both copper and optical fiber communication media.
4. Third-Party Interfaces
   a. BMCS installer shall integrate real-time data from systems supplied by other trades as required in Part 3.
   b. The BMCS system shall include necessary BMCS hardware equipment and software to allow data communications between the BMCS system and systems supplied by other trades.
   c. The trade installer supplying other systems will provide their necessary hardware and software and will cooperate fully with the BMCS installer in a timely manner at their cost to ensure complete data integration.
5. Uninterruptible Power Supply (UPS)
   a. Where indicated for supporting operator PCs, servers, and other equipment as indicated, provide a UPS.
   b. UPS shall be sized for 50% spare capacity. The UPS shall be complete with batteries, external bypass and line conditioning.

6. Power Fail / Auto Restart
    a. Provide for the automatic orderly and predefined shutdown of parts or all of the BMCS following total loss of power to parts or all of the BMCS.
    b. Provide for the automatic orderly and predefined startup of parts or all of the BMCS following total loss of power to those parts or all of the BMCS. Archive and annunciate time and details of restoration.
    c. Provide for the orderly and predefined scheduling of controlled return to normal, automatically time scheduled, operation of controlled equipment as a result of the auto restart processes.
    d. Maintain the BMCS real-time clock operation during periods of power outage for a minimum of 72 hours.
7. Downloading and Uploading
    a. Provide the capability to generate BMCS software-based sequences, database items and associated operational definition information and user-required revisions to same at any Operator PC, and the means to download same to the associated Application Node.
    b. Application software tool used for the generation of custom logic sequences shall be resident in both the application node and the server(s) where indicated on the drawings.
    c. Provide the capability to upload BMCS operating software information, database items, sequences and alarms to the designated server(s).
    d. The functions of this Part shall be governed by the codes, approvals and regulations applying to each individual BMCS application.

B. Operator Workstations
1. The operator workstation PCs shall provide the primary means of communication with the BMCS and shall be used for operations, engineering, management, audit, reporting and other related functions.
2. All PCs shall operate independently and concurrently without interference and under individual user password protection.
3. PCs functionality shall be individually definable by software means such that PC may be designated for specific limited users and may also be readily re-designated to provide operator workstation back-up to other operator workstations in the BMCS.
4. Portable operator terminals shall operate identically to the fixed operator workstation PC.
5. Fixed or portable operator PCs shall not require any special software to be purchased from the BMCS manufacturer. All actions required for the complete operator interface as described herein shall be accomplished through a common browser.

C. Servers
1. Where communication rooms are shown on the drawings, provide servers that will provide archive locations for all historical data such as trends, alarm and event histories, and transaction logs.
2. Equip servers with the same tool set that is located in the primary application nodes for the system configuration and custom logic definition.
3. Equip servers with the same tool set that is located in the primary application nodes for graphic configuration.
4. Access to all information on the server will be through the same user interface used to access individual nodes. When logged onto a server the operator will be able to also interact with any of the primary nodes in the facility.
5. The hardware platform for servers will, at minimum, consist of:
    a. PC processor with minimum 64-bit word structure.
    b. Minimum 2 GHz processor speed.
    c. Minimum 1 gigabyte on board ram
    d. Hard drive or equal high-speed data storage, minimum 50 gigabytes.
    e. OS shall be Windows 2000 Professional or Windows XP Professional
    f. Removable high-speed data storage and export device(s) such as Read/Write CD ROM or approved equal.
    g. Full ASCII keyboard and digital Mouse or equal pointing device.

h. Full color, flat screen VDU display unit, minimum 17 inches diagonal screen, minimum 1280 x 1024 resolution, 0.26 or better dot pitch and minimum 72 Hz refresh rate.

D. Operator Interface

1. General

a. The BMCS Operator Interface shall be user friendly, readily understood and shall make maximum use of colors, graphics, icons, embedded images, animation, text based information and data visualization techniques to enhance and simplify the use and understanding of the BMCS by authorized users at the OWS.

b. It shall be possible to designate any PC on the Tier 1 network as an Operator Interface point. No special software will need to be purchased from the BMCS manufacturer for any such PC.

c. User access to the BMCS shall be protected by a flexible and Owner redefinable software-based password access protection. Password protection shall be multi-level and partitionable to accommodate the varied access requirements of the different user groups. Provide the means to define unique access privileges for each individual authorized user. Also provide the means to establish general password groups to which an individual will then be assigned. Once assigned to the group each individual will assume all the capabilities and restrictions of that group. Provide the means to on-line manage password access control under the control of a Master Password.

d. The user interface shall be able to combine data from any and all of the system components in a single browser window. This shall include historical data stored on a server.

e. The Operator Interface shall incorporate comprehensive support for functions including, but not necessarily limited to, the following:

1) User access for selective information retrieval and control command execution
2) Monitoring and reporting
3) Alarm, non-normal, and return to normal condition annunciation
4) Selective operator override and other control actions
5) Information archiving, manipulation, formatting, display and reporting
6) BMCS internal performance supervision and diagnostics
7) On-line access to user HELP menus
8) On-line access to current BMCS as-built records and documentation
9) Means for the controlled re-programming, re-configuration of BMCS operation and for the manipulation of BMCS database information in compliance with the prevailing codes, approvals and regulations for individual BMCS applications.

f. Provide BMCS reports and displays making maximized use of simple English language descriptions and readily understood acronyms, abbreviations and the like to assist user understanding and interpretation. All text naming conventions shall be consistent in their use and application throughout the BMCS.

g. All PC-based configurations shall operate on Microsoft® Windows 2000 or Windows XP.

h. Each fixed and portable PC shall be on-line configurable for specific applications, functions and groups of BMCS points.

2. Navigation Trees

a. The system will have the capability to display multiple navigation trees that will aid the operator in navigating throughout all systems and points connected. At minimum provide a tree that identifies all systems on the networks.

b. Provide the ability for the operator add custom trees. The operator will be able to define any logical grouping of systems or points and arrange them on the tree in any order. It shall be possible to nest groups within other groups. Provide at minimum 5 levels of nesting.

c. The navigation trees shall be “dockable” to other displays in the user interface such as graphics. This means that the trees will appear as part of the display, but can be detached and then minimized to the Windows task bar or closed altogether. A simple keystroke will reattach the navigation to the primary display of the user interface.

3. Dividable display panels
   a. It shall be possible for the operator to divide the display area within a single browser window into multiple display panels. The content of each display panel can be any of the standard summaries and graphics provided by the system.
   b. Provide each display panel with minimize, maximize, and close icons.
4. Alarms
   a. Alarms shall be routed directly from primary application nodes to PCs and servers. It shall be possible for specific alarms from specific points to be routed to specific PCs and servers. The alarm management portion of the OWS software shall, at the minimum, provide the following functions
      1) Log date and time of alarm occurrence.
      2) Generate a "Pop-Up" window, with audible alarm, informing a user that an alarm has been received.
      3) Allow a user, with the appropriate security level, to acknowledge, temporarily silence, or discard an alarm.
      4) Provide an audit trail on hard drive for alarms by recording user acknowledgment, deletion, or disabling of an alarm. The audit trail shall include the name of the user, the alarm, the action taken on the alarm, and a time/date stamp.
      5) Provide the ability to direct alarms to an e-mail address or alpha-numeric pager. This must be provided in addition to the pop up window described above. Systems which use e-mail and pagers as the exclusive means of annunciating alarms are not acceptable.
      6) Any attribute of any object in the system may be designated to report an alarm.
   b. The BMCS shall annunciate diagnostic alarms indicating system failures and non-normal operating conditions
   c. The BMCS shall annunciate application alarms at minimum, as required by Part 3.
5. Reports
   a. Reports shall be generated and directed to one or more of the following: User interface displays, printers, or archive at the user's option. As a minimum , the system shall provide the following reports:
      1) All points in the BMCS.
      2) All points in each BMCS application.
      3) All points in a specific AN.
      4) All points in a user-defined group of points.
      5) All points currently in alarm in an BMCS application.
      6) All points locked out in an BMCS application.
      7) All BMCS schedules.
      8) All user defined and adjustable variables, schedules, interlocks and the like.
      9) BMCS diagnostic and system status reports.
   b. Provide all applicable standard reports of the BMCS manufacturer.
   c. Provide for the generation by the user of custom reports as specified in Part 3.
6. Dynamic Color Graphics
   a. An unlimited number of graphic displays shall be able to be generated and executed.
   b. Graphics shall be based on Scalar Vector Graphic (SVG) technology.
   c. Values of real time attributes displayed on the graphics shall be dynamic and updated on the displays.
   d. The graphic displays shall be able to display and provide animation based on real-time BMCS data that is acquired, derived, or entered.
   e. The user shall be able to change values (setpoints) and states in system controlled equipment directly from the graphic display.
   f. Provide a graphic editing tool that allows for the creation and editing of graphic files. It shall be possible to edit the graphics directly while they are on line, or at an off line location for later downloading to the AN.

g. BMCS system shall be provided with a complete user expandable symbol library containing all of the basic symbols used to represent components of a typical BMCS system. Implementing these symbols in a graphic shall involve dragging and dropping them from the library to the graphic.

7. Schedules
   a. The system shall provide multiple schedule input forms for automatic BMCS time-of-day scheduling and override scheduling of BMCS operations. At a minimum, the following spreadsheet types shall be accommodated:
      1) Weekly schedules.
      2) Temporary override schedules.
      3) Special "Only Active If Today Is A Holiday" schedules.
      4) Monthly schedules.
   b. Schedules shall be provided for each system or sub-system in the BMCS. Each schedule shall include all commandable points residing within the system. Each point may have a unique schedule of operation relative to the system use schedule, allowing for sequential starting and control of equipment within the system. Scheduling and rescheduling of points shall be accomplished easily via the system schedule spreadsheets.
   c. Monthly calendars for a 12-month period shall be provided that allow for simplified scheduling of holidays and special days in advance. Holidays and special days shall be user-selected with the pointing device or keyboard, and shall automatically reschedule equipment operation as previously defined on the weekly schedules.
8. Historical trending and data collection
   a. Trend and store point history data for all BMCS points and values as selected by the user.
   b. The trend data shall be stored in a manner that allows custom queries and reports using industry-standard software tools.
   c. At a minimum, provide the capability to perform statistical functions on the historical database:
      1) Average.
      2) Arithmetic mean.
      3) Maximum/minimum values.
      4) Range – difference between minimum and maximum values.
      5) Standard deviation.
      6) Sum of all values.
      7) Variance.

E. Application Nodes (AN)
   1. Primary Application Nodes
      a. The primary application node shall perform the function of monitoring all system variables, both from real hardware points, software variables, and controller parameters such as setpoints.
      b. Application nodes shall be entirely solid state devices. No rigid disk drives will be permitted in the equipment rooms.
      c. The primary application nodes shall manage and direct all information traffic on the Tier 1 network, between the Tier 1 and Tier2 networks, and to servers.
      d. Any node on the Tier 1 network shall be equipped with all software necessary to drive the complete user interface including graphics on a browser connected to the node via the network or directly via a local port on the node.
      e. The operating system of the application node shall support multi-user access. At minimum four users shall be able to access the same application node simultaneously.
      f. Communication between nodes shall be per-to-peer via 10/100 Ethernet using the BACnet protocol.
      g. The AN shall be capable of direct connection to multiple field busses using different protocols simultaneously as indicated below. Should the controller not support multiple field busses, install two primary nodes side by side.

1) An RS-485 serial field bus such as MSTP or the manufacturer's proprietary field bus.
2) a LON field bus for supervision and control of LON based controllers that conform to the Lon Talk standard.

h. The primary nodes will integrate data from both field busses into a common object structure. Data from both field busses will appear in common displays throughout the user interface in exactly the same format. It shall not be possible to determine which field buss the data originated on without reviewing the system configuration data.
i. AN shall be programmable and governed by the requirements of their applicable codes, approvals and regulations.
j. The AN shall be designed, packaged, installed, programmed and commissioned in consideration of their specific service and prevailing operating conditions. They shall be proven standard product of their original manufacturer and not a custom product for this Project.
k. A failure at an AN shall not cause failures or non-normal operation at any other system AN other than the possible loss of active real-time information from the failed AN.
l. Ancillary AN equipment, including interfaces and power supplies, shall not be operated at more than 80% of their rated service capacity.
m. AN shall comply with FCC Part 15 subpart J class A emission requirements.
n. Each primary node shall be equipped with the necessary un-interruptible power such that it will not cease operation during minor power outages, including those that occur upon transfer to emergency generator or other local power source not provided by the utility.

2. HVAC Node
a. HVAC Node shall provide both standalone and networked direct digital control of HVAC systems.
b. A dedicated HVAC Node shall be configured and provided for each primary HVAC system (air handler, chiller, boiler) and each terminal HVAC system (VAV Box, Unit Heater, Fan Coil Unit, Cabinet Heater, Heat Pump, Fan Powered Box, CV Box)
c. Each HVAC Node shall retain program, control algorithms, and setpoint information in non-volatile memory in the event of a power failure, and shall return to normal operation upon restoration of power.
d. Each HVAC Node shall report its communication status to the BMCS. The BMCS shall provide a system advisory upon communication failure and restoration.
e. For each primary HVAC system, provide means of indication of system performance and setpoints at, or adjacent to the HVAC Node.
f. For each primary HVAC system, provide a means to adjust setpoints and start/stop equipment at, or adjacent to the HVAC Node.
g. Provide a means to prevent unauthorized personnel form accessing setpoint adjustments and equipment control functions.
h. The HVAC Node shall provide the ability to download and upload configuration data, both locally at the Node and via the BMCS communications network.
i. The HVAC Node shall be provided with a permanently-mounted local graphic terminal where required in the sequences of this specification. The local graphic terminal shall provide dynamic graphical representation of the associated system status, with the ability for the operator to enter commands with proper password protection.

F. Application Software
1. HVAC Application Software
a. Event Messaging: Provide for the automatic execution of user-defined messages on the occurrence of each predefined BMCS real-time event including equipment/point status change, approaching limit or alarm, time of day and the like. Direct messages to any number of operator PCs, e-mail destinations, and pagers.
b. Indoor Air Quality: Provide monitoring of outside air, return air and supply air CO2 concentration, calculate and maintain fresh air requirements. Adjust outdoor air intake to ensure return air CO2 high level limit is not exceeded.

c. Optimum Start/Stop: Provide software to start equipment on a sliding schedule based upon indoor and outdoor conditions, to determine the minimum time of HVAC system operation needed to satisfy the space environmental requirements. The program shall also determine the earliest possible time to stop the mechanical systems. The optimum start/stop program shall operate in conjunction with, and be coordinated with, the scheduled start/stop and night setback programs.
d. Auto Alarm Lockout: Provide for scheduled and automatic lockout of alarm annunciation from equipment during non-normal operating conditions including shutdown, emergency power operation, fire alarm and the like.
e. Energy monitoring: Provide software to monitor and totalize consumption as measured by pulse meters.
f. Event Initiated Programs and custom logic: Provide software to define custom logic sequences that will reside in the nodes. The definition software will also reside in the node and be accessible via the standard user interface via a browser.
g. System Restart: Upon restoration of the AC power to an HVAC Node, automatically restart all equipment and restore all loads to the state as required by the BMCS. Provide appropriate time delays to prevent demand surges or overload trips.
h. Heavy Equipment Delays: The system shall provide protection against excessive demand situations during start-up periods by automatically introducing time delays between successive start commands to heavy electrical loads.
i. Runtime Totalization: Automatically sample, calculate and store runtime hours for binary input and output points as listed in the point schedule of this specification.
j. Analog/Pulse Totalization: Sample, calculate and store consumption totals on a daily, weekly, or monthly basis for user-selected analog and binary pulse input-type points.

2.5 PNEUMATIC AND ELECTRICAL SYSTEM AND DEVICES

A. All electric switch devices to be selected for applied and UL listed for application. All water thermostats provided with separable copper, monel, or stainless steel well.

B. Miscellaneous, electric, pneumatic, and mechanical devices to include:
1. Control dampers less actuators shall be provided under Section 23 31 13. Actuators shall be provided by controls installer.
2. Smoke dampers and actuators indicated on plans provided by Section 23 31 13. Actuator to be factory installed, coordinate type required.
3. Automatic control valves:
a. Chilled water system control valves for new and existing air handling units shall be provided as follows:
1) Pressure independent valves with 100:1 turndown designed to maintain constant flow rate proportional to valve position regardless of inlet pressure.
2) 5% accuracy through selected operating pressure range calibrated per ANSI/NCSL Z540-1-1994.
3) Control valve bodies shall be cast iron, steel, or bronze rated at 150 PSIG. All internal parts shall be stainless steel, steel, Teflon, brass, or bronze. Plastic internal parts are not acceptable.
4) Use of valves shall eliminate need for manually balancing flow rate at each location. Valves shall have pressure ports to verify proper operation.
5) End type:
a) 2-1/2 IN and smaller: screwed type.
b) 3 IN and larger: flanged.
6) Manufacturer: Delta P.
7) Valves for fan coil units may be conventional type as specified for other systems.
b. Other systems:
1) Materials:
a) Stems: Stainless steel.
b) Packing: Spring loaded Teflon with replaceable discs.
c) Body: Bronze.

2) End type:
   a) 2-1/2 IN and smaller: screwed type.
   b) 3 IN and larger: flanged.
3) Water control valves, 4 IN size and larger: butterfly type.
4) Valves ANSI rated to withstand pressures and temperatures encountered.
5) Modulating straight through water valves provided with equal percentage contoured throttling plugs. All three way valves provided with linear throttling plugs so total flow through valve remains constant regardless of valve's position. Valves sized for pressure drop equal to coil they serve, but not to exceed 5 psi. Size two way valve operators to close valves against pump shut off head.
6) Modulating steam valves to have linear characteristics for 90 percent of closing stroke, and equal percentage for final 10 percent. Valves sized for entering steam pressure indicated with pressure drop through valves not to exceed 20 percent of main steam pressure.

c. Terminal equipment valves to be straight through or three way type as indicated. Stems polished stainless steel and packing ethylene-propylene suitable for both chilled water and 250 degree hot water service. Pressure ratings as required for intended service.

4. Firestats: 130 degF manual reset type.
5. Safety low limits: Snap acting, single pole, single or double throw, manual reset switch which trips if temperature sensed across any 12 inches of bulb length is equal to or below setpoint, requiring minimum 20 feet length of bulb. Provide one thermostat for every 20 square feet of coil surface. Mount freeze protection thermostats using flanges and element holders. Low limit thermostats shall have multiple contacts or shall be installed with relay loop to allow low limit thermostats to be directly connected to the motor starter/VFD and to the BMCS.
6. Electric thermostats: Line voltage or low voltage type suitable for application. Low voltage type heating thermostats to have adjustable heat anticipation.
7. Instrument Pressure Gages: Black letters on white background, 1-1/2 inch diameter, stem mounted with suitable dial range. Install pressure gages on main and branch lines at each receiver controller, at input to each actuator, at inputs and outputs from each relay and switch, and signal lines at each transmitter.
8. Electric Damper Actuators.
   a. Rating: NEMA 1 Enclosure
   b. Mounting: Direct mount
   c. Stroke: 90 seconds end to end full stroke, 15 seconds return to normal for spring return
   d. Protection: Electronic stall protection
   e. Control Input: 0-10 VDC or 0-20 mADC
   f. Power: Nominal 24 VAC
   g. Torque: Size for minimum 150% of required duty
   h. Duty cycle: rated for 65,000 cycles
   i. Special:
      1) Modulating actuators: Output position feedback.
      2) Two position actuators: Two auxiliary contacts for actuator position.
      3) Manual override
      4) Field selectable rotational / spring return direction
      5) Field adjustable zero and span.
9. Electric Valve Actuators.
   a. Rating: NEMA 1 Enclosure
   b. Mounting: Direct mount
   c. Control Input: Continuous 0-10 VDC or 0-20 mADC
   d. Power: Nominal 24 VAC
   e. Protection: Stall protection
   f. Torque: Size for minimum 150% of required duty
   g. Special:
      1) Modulating actuators: Output position feedback.
      2) Two position actuators: Two auxiliary contacts for actuator position.

3) Manual override.
4) Field selectable direction.
5) Field adjustable zero and span.
6) For spring return, provide field selectable spring return direction.

2.6 ELECTRONIC DATA INPUTS AND OUTPUTS

A. Input/output sensors and devices matched to requirements of remote panel for accurate, responsive, noise free signal output/input. Control input to be highly sensitive and matched to loop gain requirements for precise and responsive control.
   1. In no case shall computer inputs be derived from pneumatic sensors.

B. Temperature sensors:
   1. Except as indicated below, all space temperature sensors shall be provided with single setpoint adjustment with temperature display and unoccupied mode override button. The following are exceptions to this:
      a. The following locations shall have sensor without setpoint adjustment:
         1) All electrical and communication rooms.
         2) All mechanical rooms.
         3) All unit heaters.
         4) All public elevator lobbies and entrance vestibules.
   2. Duct temperature sensors to be averaging type. Averaging sensors shall be of sufficient length (a maximum of 1.8 sqft of cross sectional area per 1 lineal foot of sensing element) to insure that the resistance represents an average over the cross section in which it is installed. The sensor shall have a bendable copper sheath. Water sensors provided with separable copper, monel or stainless steel well. Outside air wall mounted sensors provided with sun shield.
   3. Outside air, return air, discharge air, return air, space, and well sensors to be linear with +/- .7 degF between 32 degF and 212 degF.

C. Relative humidity sensors to be capacitance type with 10 percent to 90 percent range with an accuracy of plus or minus 2 percent of full scale. Duct mounted humidity sensors provided with sampling chamber.

D. Differential and static pressure sensors and switches:
   1. The pressure transducer shall withstand up to 150 % of rated pressure with and accuracy of plus or minus 1 percent of full scale. The sensing element shall be either capsule, diaphragm, bellows, bourbon tube, or solid state. Pressure sensors (all types) installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure sensors shall have valves for isolation, venting and taps for calibration. Pressure sensors shall be verified by calibration. Differential pressure sensors shall have nulling valves.
   2. Pressure switches shall have a repetitive accuracy of plus or minus 2 percent of their operating range and shall withstand up to 150% of rated pressure. Switch shall have a snap acting form C contact rated for the application. Provide Dwyer 3000 series photohelic gauges with isolation valves and calibration taps, required power supply, and manual reset push button. Pressure switches (all types installed on liquid lines shall have drains. Pressure sensors installed on steam lines shall have drains and siphons. All pressure switches shall have valves for isolation, venting and taps for calibration. Pressure switches shall be adjusted to the proper set point and shall be verified by calibration. Pressure switches shall be mounted higher than the process connection. Differential pressure switches shall have nulling valves. Switch contact ratings and duty shall be selected in accordance with NEMA ICS 1.
   3. Fan proof-of-flow sensor to be current switch.
   4. Pump proof-of-flow sensor to be current switch.
   5. Provide differential pressure gauges for air handling unit filters in pressure ranges to match full loaded filter pressure drop plus 50% with manual reset and set point indication. Provide with isolation valves and calibration taps.

E. Flow measurement devices:
   1. Electronic Airflow Stations
      a. Air Flow and Temperature Measurement:
         1) Thermal dispersion technology anemometer using instrument grade self-heated thermistor sensors with thermistor temperature sensors.
         2) Factory tested prior to shipment and shall not require calibration or adjustment over the life of the equipment when installed in accordance to manufacturer's guidelines.
         3) Manufacturer shall provide test data for accuracy performance prior to bid date. Vortex shedding arrays are not acceptable. Pitot tube and differential pressure sensing arrays are not acceptable. Auto zeroing sensors are not acceptable.
      b. Flow Station Construction
         1) Duct or fan inlet mounted as indicated.
         2) Sensors: Two glass-encapsulated thermistors at each measuring point - self heated thermistor and temperature sensor.
            a) Glass-filled polypropylene housing.
            b) Factory-calibrated at 16 airflow rates and 3 temperatures to NIST-traceable standards for both airflow and temperature.
         3) Duct mounted probe construction:
            a) Gold anodized aluminum alloy tube
            b) 304 stainless steel mounting brackets.
            c) Constructed as insertion, internal, or standoff mounting, depending on installation requirements.
            d) Probe sensor density:

Area (sq.ft.)	Sensors
<= 1	2
>1 to< 4	4
4 to < 8	6
8 to < 12	8
12 to < 16	12
>= 16	16

            e) Probe operating ranges:
               (1) Airflow: 0 to 5000 FPM.
               (2) Temperature: -20 to 160 °F, ±0.15 ºF.
               (3) Relative Humidity: 0 to 99% non-condensing.
            f) Installed accuracy of ±3% of reading or better.
         4) Fan inlet mounted probe construction:
            a) Gold anodized aluminum alloy tube
            b) 304 stainless steel mounting brackets.
            c) Probe operating ranges:
               (1) Airflow: 0 to 10,000 FPM.
               (2) Temperature: -20 to 160 °F, ±0.15 ºF
               (3) Relative Humidity: 0 to 99% non-condensing.
            d) Installed accuracy of ±10% of reading or better.
      c. Transmitter:
         1) Type: Microprocessor Based, totally solid state.
         2) Power Requirement: 24 VAC, isolated from other devices and not grounded. AFMS manufacturer shall furnish a 1:1 isolation transformer for each duct location.
         3) Capable of processing up to 16 independent sensing points per location.
         4) Output signal offset/gain adjustment.
         5) Adjustable digital filter to stabilize airflow output.
         6) Field configurable for either I.P. or S.I. units.

7) Local digital display on face of cabinet for indicating individual sensor airflow and temperature readings.
8) Wall-mounted NEMA 1 enclosure.

d. The temperature control installer shall be required to calibrate the airflow sensors with input from the air balancing provider. Air flow readings shall be taken for at least five air flows through the range of operation and fit to a linear equation and programmed into the software.

e. Performance:
1) Electronics temperature range: 30 to 120 degF.
2) Flow station pressure drop: less than 0.005 IN WC at 2000 ft./min.

f. Analog output signals: 0-10 VDC or 4-20 ma:
1) Type: linear.

g. Ebtron Gold Series or approved equal.

2. Water and steam flow meters

a. Turbine flow meters:
1) Water flow meters:
a) Type: Insertion turbine type with retractable probe assembly and 2 IN full port gate valve.
b) Pipe size: 3 to 24 IN.
c) Retractor: ASME threaded, non-rising stem type with hand wheel.
d) Mounting connection: 2 IN 150 PSI flange.
e) Rotor assembly: Design for expected water flow and pipe size.
f) Seal: Teflon (PTFE).
g) Controller:
(1) Integral to unit.
(2) Locally display flow rate and total.
(3) Output flow signal to BMCS: Digital pulse type.
h) Performance:
(1) Accuracy: 1.0% of reading
(2) Repeatability: 0.25% of reading
(3) Turndown: 30:1
i) Power: 24 volt DC
j) Manufacturer: Onicon F-1200 Dual Turbine

b. Install flow meters according to manufacturer's recommendations. Where recommended by manufacturer because of mounting conditions, provide flow rectifier.

c. The temperature control installer shall be required to calibrate the flow meter with input from the balancing provider (Section 20 08 00). Flow readings shall be taken for at least five flows through the range of operation and fit to a linear equation and programmed into the software.

F. Carbon Dioxide Sensors:
1. Non-dispersive infrared technology.
2. Measuring range: 0-5000 ppm.
3. Accuracy: ±5% or reading or ±100 ppm, whichever is greater.
4. Repeatability: ±20 ppm.
5. Maximum Drift per year: ±100 ppm.
6. Response Time (@ 500ml/min.): <=1 min.
7. Dry contact CO_2 alarm threshold adjustable over range of 0 to 5000 ppm.
8. Analog output 0-5 VDC or 4-20 mA over full sensed range.
9. Zero and span adjustment.
10. Provide aspirating box to permit measurement of return air duct carbon dioxide level. Box to be mounted to outside of duct, allowing access to sensor for maintenance.
11. Telaire Systems, Inc.

G. Outputs: Control relays and analog output transducers to be compatible with remote panel. Relays suitable for loads encountered. Analog output transducers designed for precision closed loop control with pneumatic repeatability error no greater than 1-1/2 percent.

2.7 PAGING INTERFACE

A. General:
   1. BMCS system shall be directly linked to paging system, notifying maintenance personnel via pager when critical events occur.
   2. The interface shall detect which critical alarms require pages, create an action statement for each page, and select who should receive the page.
   3. System shall support both numeric and alpha-numeric pagers, using Alphanumeric, PET, or IXO Protocol at the owner’s option.
   4. Users shall have the ability to modify the phone number or message to be displayed on the pager through the system software.
   5. System shall utilize pager schedules to send pages to the personnel that are “on-call”.
   6. Installer shall be responsible for providing a modem for connection to the paging service.

B. Message Configuration:
   1. After paging interface is installed and software is fully functional, the installer shall spend 8 hours with Owner configuring system to Owner's satisfaction.

PART 3 - EXECUTION

3.1 GENERAL

A. The Building Management and Control System (BMCS) shall be designed, installed, and commissioned in a turnkey fully implemented and operational manner; including all labor not noted in the Work by Others paragraph of Part I of this section of these specifications, and not noted in other sections of these specifications.

3.2 SEQUENCE OF OPERATION

A. General:
   1. HVAC systems shall be controlled with Direct Digital Control (DDC) according to sequence contained in this section of specifications and shall be stand-alone.
      a. Additional points or software programming not listed but which are required to meet following sequences of operation shall be provided.
   2. House controllers, relays, transducers, and other components required for stand-alone control in NEMA 1 enclosure with lockable door.
   3. All VFD's shall be monitored by BMCS for trouble conditions. Signal shall be a set of dry contacts. Operator will use VFD control panel for diagnostics.
   4. Setpoints:
      a. All setpoints given in the sequence of operations or in the drawings are for system startup and are preliminary. Optimum operating setpoints must be determined during actual occupancy and will be affected by many factors. These may include:
         1) Weather conditions.
         2) Building occupancy.
         3) Building utilization patterns.
         4) Variations in building construction.
         5) Variations in operating characteristics of actual installed building equipment.
      b. It is the responsibility of the building operators to determine those settings and operating methods which provide the best balance of operating efficiency and occupant comfort. This is an ongoing process. Optimum settings change as operating conditions change.

c. Current switches for motor starters shall be set to indicate failure of motor, For motors with VFDs, the setting shall be below normal minimum operating point. For belt driven motors, the setting shall be capable of detecting belt breakage.

5. The position of all valve and damper actuators shall be communicated to the BMCS.
   a. Modulating actuators: Utilize feedback signal integral to actuator (or equivalent external device).
   b. Two position actuators: Utilize auxiliary contacts integral to actuator (or equivalent external device) to indicate full open position. Full closed position shall also be indicated where specifically required by sequence of operation.
   c. Position feedback shall not be required for air terminal unit, unit heater, or fan coil unit actuators.
6. Where space temperature sensors have setpoint adjustment and unoccupied mode override button, the unoccupied mode shall be overridden to occupied mode of operation for one hour (adj.), unless specified otherwise.

3.3 AIR HANDLING UNITS

A. Air Handling Units for Variable Volume Systems (AHU-1):
   1. Safety Controls:
      a. Provide low limit thermostat with manual reset downstream of the heating coil. When the low limit thermostat senses a temperature less than 38 degF (adj.), the supply and return fans shall stop.
      b. Provide external end switches on the supply and return duct smoke dampers which isolate the air handling unit. The supply and return fans shall not be allowed to start unless all of the isolation smoke dampers are proven open by the end switches. Provide timed delay relays to close isolation smoke dampers, whenever the fans are off.
      c. Provide supply fan suction pressure with manual reset to shut down supply and return fans if supply fan suction static pressure exceeds switch setpoint.
      d. Upon activation of fire alarm system, the supply and return fans shall stop via fire alarm relays (see electrical).
      e. The isolation smoke damper end switches, supply fan suction pressure switch, fire alarm relays (see electrical) and the low limit thermostat shall be wired directly to the supply and return fan variable frequency drives (VFD) independent of the BMCS to allow the supply and return fans to shut down in any mode of drive operation (ie, automatic, manual, or bypass).
      f. Provide differential pressure switches across each individual filter bank to alarm BMCS when loaded. Alarm set point for prefilter shall be 0.75” (adj.) and the alarm set point for the final filter shall be 1” (adj.).
      g. Provide return air temperature sensor (insertion type) and humidity sensor in return duct immediately upstream of the air handling unit for monitoring purposes.
      h. Provide supply air temperature sensor (insertion type) and humidity sensor in supply duct immediately downstream of the air handling unit for monitoring purposes.
      i. Provide dry contact on the positive and negative pressure relief door. BMCS shall alarm when either pressure relief door opens.
   2. Supply Fan Control:
      a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
      b. The supply fans shall be served by individual VFD’s. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the supply duct static pressure sensor setting (adj.). Upon failure of a VFD, a warning shall be sent to the BMCS. Supply duct static pressure setting shall be coordinated with balancing contractor. For multiple supply fans, the fans shall operate in unison at the same speed.
         1) Locate supply duct static pressure sensor in the high pressure ductwork downstream of the unit 2/3 of the distance from the unit.

c. The airflow of the supply fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.
d. Provide each supply fan with current sensor for fan status. BCMS shall provide fan failure alarm.
e. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.

3. Return Fan Control:
   a. If safety controls are normal, the VFD(s) for the return fan(s) shall be enabled by the BMCS and shall run continuously.
   b. The return fans shall be served by individual VFD's. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the calculated return air quantity. Upon failure of a VFD a warning shall be sent to the BMCS. For multiple supply fans, the fans shall operate in unison at the same speed. Setting shall be coordinated with balancing contractor.
   c. The calculated return airflow stated above shall be determined by the following equation:
      1) Total Return CFM = Total Supply CFM - (C x Total Exhaust CFM).
         a) The total supply CFM is as measured by the supply fan air flow station(s).
         b) The total exhaust CFM is determined by totaling the exhaust CFM.
         c) The calculated total exhaust CFM shall include only those exhaust fans which are on.
         d) Coordinate actual exhaust CFM quantities with balancing provider.
         e) The "C" multiplier is a space pressurization factor and the minimum valve shall be 1.0. The multiplier shall be automatically adjusted to maintain a space static pressure of approximately 0.05 IN WG (adj.) relative to the outside.
         f) Maximum value for Total Return CFM shall be 90% (adj.) of Total Supply CFM (This is to account for unoccupied modes of operation where exhaust fans may be off and "C x Total Exhaust CFM" value equals zero.).
   d. The airflow of the return fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.
   e. Provide each return fan with current switch for fan status. BCMS shall provide fan failure alarm.
   f. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.
4. Outside Air and Return Air Damper Control:
   a. When the economizer control is inactive, modulate the outside air damper and return air damper as required to maintain the scheduled minimum outside air quantity of 8,000 cfm (adj.) as measured by the outside airflow station. The airflow station transmitter provides a linear control signal to the BMCS proportional to airflow.
   b. When the economizer control is active, the outside air damper and the return air damper shall modulate as required to maintain a mixed air temperature of 52 degF (adj.). The outside air damper and the return air damper shall modulate as required to maintain the mixed air temperature setpoint while ensuring that the minimum outside air setting is maintained.
   c. The economizer control shall be activated when the outside air temperature is less than 65 deg F (adj.).
   d. When the supply and return fans are off, the normally closed outside air damper shall be closed, and the normally open return air damper shall be open.
5. Relief Air Damper Control:
   a. The relief air damper shall be modulated as required to maintain a differential static pressure of 0.25 IN WG(adj.) across the relief damper with the fan discharge side being the high pressure side.
   b. When the supply and return fans are off, the normally-closed relief damper shall be closed.
6. Heating Water Preheat Coil Control:

a. If the mixed air temperature is below 50 degF (adj.) or if the outdoor air temperature is below 40 degF (adj.), the preheat coil control shall be enabled.
b. Modulate the control valve as required to maintain a supply discharge air temperature of 54 degF (adj.).
c. When the supply and return fans are off and the outdoor air temperature is 40 degF (adj.) or below, the normally-open control valve shall be 100% open.
d. In addition to the low limit thermostat, provide an averaging type temperature sensor downstream of the preheat coil. At a temperature of 40 degF (adj.), send a warning alarm to the BMCS indicating "potential coil freezing conditions present".

7. Chilled Water Cooling Coil Control:
   a. When outside air temperature is above 50 degF (adj.) and chilled water is available, the chilled water cooling coil control shall be enabled.
   b. The chilled water control valve shall modulate as required to maintain a supply discharge air temperature of 55 degF (adj.).
   c. When the supply and return fans are off, the normally-closed two-way chilled water control valve shall be closed.
   d. For monitoring purposes, provide temperature sensors in the supply water to and the return water from the chilled water coil.

B. Air Handling Units for Variable Volume Dual Duct Systems (AHU-20A):
1. Safety Controls:
   a. Provide low limit thermostat with manual reset downstream of the heating coil. When the low limit thermostat senses a temperature less than 38 degF (adj.), the supply and return fans shall stop.
   b. Provide external end switches on the supply and return duct smoke dampers which isolate the air handling unit. The supply and return fans shall not be allowed to start unless all of the isolation smoke dampers are proven open by the end switches. Provide timed delay relays to close isolation smoke dampers, whenever the fans are off.
   c. Provide supply fan suction pressure with manual reset to shut down supply and return fans if supply fan suction static pressure exceeds switch setpoint.
   d. Upon activation of fire alarm system, the supply and return fans shall stop via fire alarm relays (see electrical).
   e. The isolation smoke damper end switches, supply fan suction pressure switch, fire alarm relays (see electrical) and the low limit thermostat shall be wired directly to the supply and return fan variable frequency drives (VFD) independent of the BMCS to allow the supply and return fans to shut down in any mode of drive operation (ie, automatic, manual, or bypass).
   f. Provide differential pressure switches across each individual filter bank to alarm BMCS when loaded. Alarm set point for prefilter shall be 0.75" (adj.) and the alarm set point for the final filter shall be 1" (adj.).
   g. Provide return air temperature sensor (insertion type) and humidity sensor in return duct immediately upstream of the air handling unit for monitoring purposes.
   h. Provide hot deck supply air temperature sensor (insertion type) and humidity sensor in hot deck supply duct immediately downstream of the air handling unit for monitoring purposes.
   i. Provide dry contact on the positive and negative pressure relief door. BMCS shall alarm when either pressure relief door opens.
2. Hot Deck Supply Fan Control:
   a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
   b. The supply fans shall be served by individual VFD's. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the supply duct static pressure sensor setting (adj.). Upon failure of a VFD, a warning shall be sent to the BMCS. Supply duct static pressure setting shall be coordinated with balancing contractor. For multiple supply fans, the fans shall operate in unison at the same speed.

1) Locate supply duct static pressure sensor in the high pressure ductwork downstream of the unit 2/3 of the distance from the unit.

c. The airflow of the supply fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.

d. Provide each supply fan with current sensor for fan status. BCMS shall provide fan failure alarm.

e. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.

3. Cold Deck Supply Fan Control:

a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.

b. The supply fans shall be served by individual VFD's. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the supply duct static pressure sensor setting (adj.). Upon failure of a VFD, a warning shall be sent to the BMCS. Supply duct static pressure setting shall be coordinated with balancing contractor. For multiple supply fans, the fans shall operate in unison at the same speed.

1) Locate supply duct static pressure sensor in the high pressure ductwork downstream of the unit 2/3 of the distance from the unit.

c. The airflow of the supply fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.

d. Provide each supply fan with current sensor for fan status. BCMS shall provide fan failure alarm.

e. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.

4. Return Fan Control:

a. If safety controls are normal, the VFD(s) for the return fan(s) shall be enabled by the BMCS and shall run continuously.

b. The return fans shall be served by individual VFD's. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the calculated return air quantity. Upon failure of a VFD a warning shall be sent to the BMCS. For multiple supply fans, the fans shall operate in unison at the same speed. Setting shall be coordinated with balancing contractor.

c. The calculated return airflow stated above shall be determined by the following equation:

1) Total Return CFM = Total Supply CFM (Hot Deck CFM + Cold Deck CFM) - (C x Total Exhaust CFM).

a) The total supply CFM is as measured by the supply fan air flow station(s).

b) The total exhaust CFM is determined by totaling the exhaust CFM.

c) The calculated total exhaust CFM shall include only those exhaust fans which are on.

d) Coordinate actual exhaust CFM quantities with balancing provider.

e) The "C" multiplier is a space pressurization factor and the minimum valve shall be 1.0. The multiplier shall be automatically adjusted to maintain a space static pressure of approximately 0.05 IN WG (adj.) relative to the outside.

f) Maximum value for Total Return CFM shall be 90% (adj.) of Total Supply CFM (This is to account for unoccupied modes of operation where exhaust fans may be off and "C x Total Exhaust CFM" value equals zero.).

d. The airflow of the return fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.

e. Provide each return fan with current switch for fan status. BCMS shall provide fan failure alarm.

f. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.

5. Cold Deck Outside Air and Return Air Damper Control:

a. When the economizer control is inactive, the outdoor airflow quantity shall be determined by the follow calculation: Outdoor Air CFM = Cold Deck CFM – (Total Return Air CFM – Hot Deck CFM), otherwise the minimum outdoor airflow of 9,000 cfm (adj.) as measured by the outside airflow station shall be maintained. Modulate the outside air damper and return air damper as required to maintain the outdoor airflow quantity. The airflow station transmitter provides a linear control signal to the BMCS proportional to airflow.
b. When the economizer control is active, the outside air damper and the return air damper shall modulate as required to maintain a mixed air temperature of 52 degF (adj.). The outside air damper and the return air damper shall modulate as required to maintain the mixed air temperature setpoint while ensuring that the minimum outside air setting is maintained.
c. The economizer control shall be activated when the outside air temperature is less than 65 deg F (adj.).
d. When the supply and return fans are off, the normally closed outside air damper shall be closed, and the normally open return air damper shall be open.

6. Hot Deck Return Air Damper Control:
   a. The return air damper shall operate fully open when all controls are normal. If damper does not fully open a warning shall be sent to the BMCS.
   b. The return air damper shall fully close upon safety controls (see above).
7. Relief Air Damper Control:
   a. The relief air damper shall be modulated as required to maintain a differential static pressure of 0.25 IN WG(adj.) across the relief damper with the fan discharge side being the high pressure side.
   b. When the supply and return fans are off, the normally-closed relief damper shall be closed.
8. Heating Water Preheat Coil Control:
   a. If the mixed air temperature is below 50 degF (adj.) or if the outdoor air temperature is below 40 degF (adj.), the preheat coil control shall be enabled.
   b. Modulate the control valve as required to maintain a supply discharge air temperature of 54 degF (adj.).
   c. When the supply and return fans are off and the outdoor air temperature is 40 degF (adj.) or below, the normally-open control valve shall be 100% open.
   d. In addition to the low limit thermostat, provide an averaging type temperature sensor downstream of the preheat coil. At a temperature of 40 degF (adj.), send a warning alarm to the BMCS indicating “potential coil freezing conditions present”.
9. Hot Deck Heating Water Coil Control:
   a. Modulate the control valve as required to maintain a supply discharge air temperature of 100 degF (adj.).
   b. When the supply and return fans are off and the outdoor air temperature is 40 degF (adj.) or below, the normally-open control valve shall be 100% open.
10. Chilled Water Cooling Coil Control:
    a. When outside air temperature is above 50 degF (adj.) and chilled water is available, the chilled water cooling coil control shall be enabled.
    b. The chilled water control valve shall modulate as required to maintain a supply discharge air temperature of 55 degF (adj.).
    c. When the supply and return fans are off, the normally-closed two-way chilled water control valve shall be closed.
    d. For monitoring purposes, provide temperature sensors in the supply water to and the return water from the chilled water coil.
11. Direct Injection Steam Humidifier Control (as applicable):
    a. When outdoor air temperature is below 50 degF (adj.), the humidifier control shall be enabled and the normally-closed two position jacket steam control valve shall be open.
    b. When the supply fan and return fans are proved to be on, the humidifier control valve (furnished with humidifier) shall modulate as required to maintain a return plenum relative humidity of 30% (adj.).

c. The humidifier control valve shall not be allowed to open unless temperature switch (furnished with humidifier) is satisfied. The temperature switch shall be interfaced directly to the humidifier control valve independent of the BMCS.
d. If supply duct relative humidity exceeds 85% (adj.) as sensed by humidity sensor located in the air handling unit supply plenum upstream of final filters, the humidifier control valve shall be suppressed.

C. Air Handling Units for Variable Volume Systems (AHU-20B):
1. Safety Controls:
a. Provide low limit thermostat with manual reset downstream of the heating coil. When the low limit thermostat senses a temperature less than 38 degF (adj.), the supply and return fans shall stop.
b. Provide external end switches on the supply and return duct smoke dampers which isolate the air handling unit. The supply and return fans shall not be allowed to start unless all of the isolation smoke dampers are proven open by the end switches. Provide timed delay relays to close isolation smoke dampers, whenever the fans are off.
c. Provide supply fan suction pressure with manual reset to shut down supply and return fans if supply fan suction static pressure exceeds switch setpoint.
d. Upon activation of fire alarm system, the supply and return fans shall stop via fire alarm relays (see electrical).
e. The isolation smoke damper end switches, supply fan suction pressure switch, fire alarm relays (see electrical) and the low limit thermostat shall be wired directly to the supply and return fan variable frequency drives (VFD) independent of the BMCS to allow the supply and return fans to shut down in any mode of drive operation (ie, automatic, manual, or bypass).
f. Provide differential pressure switches across each individual filter bank to alarm BMCS when loaded. Alarm set point for prefilter shall be 0.75” (adj.) and the alarm set point for the final filter shall be 1” (adj.).
g. Provide return air temperature sensor (insertion type) and humidity sensor in return duct immediately upstream of the air handling unit for monitoring purposes.
h. Provide dry contact on the positive and negative pressure relief door. BMCS shall alarm when either pressure relief door opens.
2. Supply Fan Control:
a. If safety controls are normal, the VFD(s) for the supply fan(s) shall be enabled by the BMCS and shall run continuously.
b. The supply fans shall be served by individual VFD’s. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the supply duct static pressure sensor setting (adj.). Upon failure of a VFD, a warning shall be sent to the BMCS. Supply duct static pressure setting shall be coordinated with balancing contractor. For multiple supply fans, the fans shall operate in unison at the same speed.
1) Locate supply duct static pressure sensor in the high pressure ductwork downstream of the unit 2/3 of the distance from the unit.
c. The airflow of the supply fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.
d. Provide each supply fan with current sensor for fan status. BCMS shall provide fan failure alarm.
e. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.
3. Return Fan Control:
a. If safety controls are normal, the VFD(s) for the return fan(s) shall be enabled by the BMCS and shall run continuously.

b. The return fans shall be served by individual VFD's. The VFDs shall operate in unison. The VFDs shall vary the speed of the fan motors as required to maintain the calculated return air quantity. Upon failure of a VFD a warning shall be sent to the BMCS. For multiple supply fans, the fans shall operate in unison at the same speed. Setting shall be coordinated with balancing contractor.
c. The calculated return airflow stated above shall be determined by the following equation:
   1) Total Return CFM = Total Supply CFM - (C x Total Exhaust CFM).
      a) The total supply CFM is as measured by the supply fan air flow station(s).
      b) The total exhaust CFM is determined by totaling the exhaust CFM.
      c) The calculated total exhaust CFM shall include only those exhaust fans which are on.
      d) Coordinate actual exhaust CFM quantities with balancing provider.
      e) The "C" multiplier is a space pressurization factor and the minimum valve shall be 1.0. The multiplier shall be automatically adjusted to maintain a space static pressure of approximately 0.05 IN WG (adj.) relative to the outside.
      f) Maximum value for Total Return CFM shall be 90% (adj.) of Total Supply CFM (This is to account for unoccupied modes of operation where exhaust fans may be off and "C x Total Exhaust CFM" value equals zero.).
d. The airflow of the return fan(s) shall be measured through inlet airflow stations that are part of the fan wall array (see Section 237323) and send the signal to the BMCS.
e. Provide each return fan with current switch for fan status. BCMS shall provide fan failure alarm.
f. Provide current switch for active noise control system. BCMS shall provide active noise control failure alarm.

4. Outside Air and Return Air Damper Control:
   a. When the economizer control is inactive, modulate the outside air damper and return air damper as required to maintain the scheduled minimum outside air quantity of 13,600 cfm (adj.) as measured by the outside airflow station. The airflow station transmitter provides a linear control signal to the BMCS proportional to airflow.
   b. When the economizer control is active, the outside air damper and the return air damper shall modulate as required to maintain a mixed air temperature of 52 degF (adj.). The outside air damper and the return air damper shall modulate as required to maintain the mixed air temperature setpoint while ensuring that the minimum outside air setting is maintained.
   c. The economizer control shall be activated when the outside air temperature is less than 65 deg F (adj.).
   d. When the supply and return fans are off, the normally closed outside air damper shall be closed, and the normally open return air damper shall be open.
5. Relief Air Damper Control:
   a. The relief air damper shall be modulated as required to maintain a differential static pressure of 0.25 IN WG(adj.) across the relief damper with the fan discharge side being the high pressure side.
   b. When the supply and return fans are off, the normally-closed relief damper shall be closed.
6. Heating Water Preheat Coil Control:
   a. If the mixed air temperature is below 50 degF (adj.) or if the outdoor air temperature is below 40 degF (adj.), the preheat coil control shall be enabled.
   b. Modulate the control valve as required to maintain a supply discharge air temperature of 54 degF (adj.).
   c. When the supply and return fans are off and the outdoor air temperature is 40 degF (adj.) or below, the normally-open control valve shall be 100% open.
   d. In addition to the low limit thermostat, provide an averaging type temperature sensor downstream of the preheat coil. At a temperature of 40 degF (adj.), send a warning alarm to the BMCS indicating "potential coil freezing conditions present".
7. Chilled Water Cooling Coil Control:

a. When outside air temperature is above 50 degF (adj.) and chilled water is available, the chilled water cooling coil control shall be enabled.
b. The chilled water control valve shall modulate as required to maintain a supply discharge air temperature of 55 degF (adj.).
c. When the supply and return fans are off, the normally-closed two-way chilled water control valve shall be closed.
d. For monitoring purposes, provide temperature sensors in the supply water to and the return water from the chilled water coil.

8. Direct Injection Steam Humidifier Control (as applicable):
   a. When outdoor air temperature is below 50 degF (adj.), the humidifier control shall be enabled and the normally-closed two position jacket steam control valve shall be open.
   b. When the supply fan and return fans are proved to be on, the humidifier control valve (furnished with humidifier) shall modulate as required to maintain a return plenum relative humidity of 30% (adj.).
   c. The humidifier control valve shall not be allowed to open unless temperature switch (furnished with humidifier) is satisfied. The temperature switch shall be interfaced directly to the humidifier control valve independent of the BMCS.
   d. If supply duct relative humidity exceeds 85% (adj.) as sensed by humidity sensor located in the air handling unit supply plenum upstream of final filters, the humidifier control valve shall be suppressed.

3.4 2ND FLOOR OUTDOOR AIR COMBINATION LOUVER/MOTORIZED DAMPER CONTROL

A. When AHU-20A and AHU-20B are operational all combination louver/motorized dampers shall be open. The control contractor shall work with the balancing contractor to balance the motorized dampers such that under minimum outdoor airflow, full economizer mode, and 50% outdoor airflow for both units the face velocity through each combination louver motorized damper are within 10% of each other. The motorized damper position for each louver shall be sequenced through the BMCS to maintain constant face velocity through all operating ranges. If the air handling units are offline, the combination louver/motorized dampers shall close. A warning shall be sent to the BMCS if any of the combination louver/motorized dampers do not open or close based on AHU operation.

3.5 MISCELLANEOUS FANS

A. All exhaust fans with constant speed starters shall be controlled as follows (unless indicated otherwise).
   1. Fans shall run continuously. Provide control relay to allow fans to be manually enabled/disabled remotely through the BMCS.
   2. Provide each fan with current switch for fan status.

B. All exhaust fans with Variable Frequency Drives (VFD's) shall be controlled as follows (unless indicated otherwise).
   1. Fans shall run continuously. Provide control relay to allow fans to manually enabled/disabled remotely through the BMCS.
   2. Fans shall be controlled to maintain test and balance established fan speed required for exhaust flow.
   3. Provide each fan with current switch for fan status.

C. Where an exhaust fan is shown or specified with a control damper, the fan shall not be allowed to operate unless associated normally closed, two position control damper with electric actuator is proven open by end switch. If fan is off, the associated control damper shall be closed. A warning shall be sent to the BMCS if associated motorized damper fails to open or close.

3.6 AIR TERMINAL UNITS

A. General:
   1. Minimum Airflow Percentages for Variable Volume Air Terminal Units

a. As indicated on HVAC plans.
b. Unless indicated otherwise, the minimum air flow percentage for VVR-# units shall be 30%.
c. Unless indicated otherwise, the minimum air flow percentage for VV-# units shall be 0%.

2. Unoccupied Mode Determination:
   a. Rooms as indicated on electrical plans that show Occupancy Sensor/Switch (OS) shall be wired to the dry contact on the sensor to initiate the terminal box into unoccupied mode.
   b. LT SW indicates light switch interlock. Installer is to monitor all room light circuits, task lighting vs general lighting as well as multi level lights.
   c. OCC indicates occupancy sensor. Installer is to provide enough sensors to cover room area.
   d. Unless indicated otherwise, unoccupied mode for each air terminal unit shall be individually programmable by Owner via time schedule. This includes spaces requiring 24 hour operation for occupied mode, as space may be temporarily placed out of service by Owner.
3. Air System Balancing:
   a. Each air handling system shall have ability to set air terminal operation to “automatic” or “design” operation for balancing purposes. This shall be accomplished by a single, password protected command through the BMCS at the operator workstation.
   b. During the “automatic” mode, all air terminal units shall function as normal.
   c. During the “design” mode, all air terminal units shall operate at their maximum airflow setting to simulate design condition.
4. Provide each terminal unit with discharge air temperature sensor for monitoring purposes.
5. Perimeter heat refers to finned tube or radiant panels as indicated on plans. When perimeter heat is sequenced with a reheat coil, the perimeter heat shall be initiated prior to the reheat coil.
6. Trend Logs:
   a. The following trend logs, with readings taken every 15 minutes, shall be set up by the contractor for each air terminal unit:
      1) Discharge air temperature.
      2) Room Air temperature.
      3) Occupied or unoccupied setting (as applicable).
      4) Room temperature set point.
      5) Supply air cfm.
      6) Space relative humidity (for rooms with humidity sensors).

B. Single duct, constant volume unit with reheat (CVR-#), with or without perimeter heat, direct digital controls:
   1. Occupied cooling and heating mode:
      a. Modulate hot water control valve(s) for reheat coil and perimeter heat (as applicable) in sequence as required to maintain room sensor set point and uniform space temperature throughout the room. If outdoor air temperature is above 60 deg F(adj.), the perimeter heat control valve shall remain closed(as applicable).
      b. Modulate damper as required to maintain constant air volume.
   2. Unoccupied cooling mode:
      a. For rooms which are not exhausted or pressurized, the supply air volume shall modulate as required to maintain a minimum space temperature of 85 degF(adj.). The minimum airflow setting during unoccupied mode shall be 25% of actual maximum airflow. Room set point adjustment on sensor shall be inactive.
      b. For rooms which are exhausted (i.e. negative) or pressurized, the minimum supply air volume shall remain at 100% of design value during unoccupied mode to ensure that pressure relationship is maintained. Examples of such spaces are corridors, protective environment rooms, central supply department, clean workrooms, soiled workrooms, etc.

3. Unoccupied heating mode:
    a. The minimum airflow setting during unoccupied mode shall be 25% of actual maximum airflow. When air terminal unit is at it unoccupied mode minimum airflow setting, modulate hot water control valve(s) for reheat coil and perimeter heat(as applicable) in sequence as required to maintain minimum room temperature of 65 degF(adj.). If outdoor air temperature is above 60 degF(adj.), the perimeter heat control valve shall remain closed(as applicable). Room set point adjustment on sensor shall be inactive.

C. Single duct variable volume with or without reheat(VVR-#, VV-#), with or without perimeter heat and with or without carbon dioxide sensors, direct digital controls:
1. Occupied cooling mode:
    a. Room sensor, through DDC controller, shall modulate damper between maximum and minimum airflow settings as required to maintain set point. Minimum airflow percentage shall be as indicated on air terminal unit equipment schedule.
    b. If carbon dioxide sensor (if applicable) senses a 1000 ppm (adj.) count, the terminal box shall increase the supply airflow to the space incrementally 100 additional cfm (adj.) every 15 minutes (adj.) until the carbon dioxide sensor reaches 900 ppm (adj.). Once terminal box reaches its ppm setpoint it shall continue to modulate to a minimum airflow rate to meet the temperature setpoint. If terminal box reaches its maximum design cfm and the carbon dioxide sensor has yet to reach 900 ppm (adj.), the air handling unit shall increase its outside air quantity an additional 1000 cfm (adj.) every 15 minutes (adj.) unit setpoint is reached and a warning shall be sent to the BMCS signaling an increase in minimum outdoor air based on monitor not reaching setpoint. If carbon dioxide sensor goes into alarm a warning shall be sent to the BMCS.
2. Occupied heating mode(units with reheat coil or perimeter heat):
    a. When air terminal unit is at its minimum airflow setting, modulate hot water control valve(s) for reheat coil and perimeter heat (as applicable) in sequence as required to maintain room sensor set point and uniform space temperature throughout the room. If outdoor air temperature is above 60 degF (adj.), the radiant panel control valve shall remain closed(as applicable).
    b. If carbon dioxide sensor (if applicable) senses a 1000 ppm (adj.) count, the terminal box shall increase the supply airflow to the space incrementally 100 additional cfm (adj.) every 15 minutes (adj.) until the carbon dioxide sensor reaches 900 ppm (adj.). Once terminal box reaches its ppm setpoint it shall continue to modulate to a minimum airflow rate to meet the temperature setpoint. If terminal box reaches its maximum design cfm and the carbon dioxide sensor has yet to reach 900 ppm (adj.), the air handling unit shall increase its outside air quantity an additional 1000 cfm (adj.) every 15 minutes (adj.) unit setpoint is reached and a warning shall be sent to the BMCS signaling an increase in minimum outdoor air based on monitor not reaching setpoint. If carbon dioxide sensor goes into alarm a warning shall be sent to the BMCS.
3. Unoccupied cooling mode:
    a. The supply air volume shall modulate as required to maintain a minimum space temperature of 85 deg F(adj.). The minimum airflow setting during unoccupied mode shall be 25% of actual maximum airflow. Room set point adjustment on sensor shall be inactive.
4. Unoccupied heating mode:
    a. The minimum airflow setting during unoccupied mode shall be 25% of actual maximum airflow. When air terminal unit is at it unoccupied mode minimum airflow setting, modulate hot water control valve(s) for reheat coil and perimeter heat(as applicable) in sequence as required to maintain minimum room temperature of 65 deg F(adj.). If outdoor air temperature is above 60 deg F(adj.), the radiant panel control valve shall remain closed(as applicable). Room set point adjustment on sensor shall be inactive.

D. Dual duct air terminal units(DD-#) for new and existing Dual Duct boxes:

1. Occupied cooling and heating mode:
   a. Dual duct air terminal unit shall be configured for variable volume operation, unless otherwise noted on the HVAC plans. The minimum airflow rate shall be set to the minimum cold deck cfm listed on the HVAC plans. Room sensor, through DDC controller shall modulate hot deck operator and cold deck operators as required to maintain space sensor setpoint.
2. Unoccupied cooling mode:
   a. The supply air volume shall modulate as required to maintain a minimum space temperature of 85 deg F(adj.). The minimum airflow setting during unoccupied mode shall be 25% of actual maximum airflow. Room set point adjustment on sensor shall be inactive.
3. Unoccupied heating mode:
   a. The minimum airflow setting during unoccupied mode shall be 25% of actual maximum airflow. When air terminal unit is at it unoccupied mode minimum airflow setting, modulate hot deck damper as required to maintain minimum room temperature of 65 deg F(adj.). Room set point adjustment on sensor shall be inactive.

3.7 SHELL AND TUBE HEAT EXCHANGERS WITH PUMPS

A. Heating Hot water Reheat System:
   1. Steam to hot water heat exchangers HX-1A and HX-1B with pumps HWP-1A and HWP-1B for heating water reheat system:
      a. Each heat exchanger and pumps are sized for 100% capacity with one pump and heat exchanger redundant.
      b. Variable frequency drive (VFD) for lead pump shall be enabled by the BMCS and shall run continuously. If lead pump fails to operate, VFD for lag pump shall be enabled and a warning shall be sent to the BMCS. Lead pump shall be alternated to ensure equal run time of pumps.
      c. The speed of the pump shall be varied as required to satisfy differential pressure sensor. Sensor location shall be as follows:
         1) 6th floor.
      d. If differential pressure senor setting can not be met and the pump is at 100%, a warning shall be sent to the BMCS.
      e. Steam control valves serving HX-1A and HX-1B are in a 1/12, 1/6, 1/3 and 2/3 arrangement. On a call for heating, the lead heat exchanger hot water isolation valve shall fully open and the 1/12 steam control valve shall modulate open to meet set point. If the 1/12 control valve is fully open and cannot maintain set point the 1/12 valve shall modulate closed and the 1/6 valve shall modulate open to maintain the set point. If the 1/6 control valve is fully open and cannot maintain set point the 1/6 valve shall modulate closed and the 1/3 and 2/3 valve shall modulate open in sequence to maintain discharge water set point per the reset schedule. Lead heat exchanger shall be alternated to ensure equal operation of heat exchangers. If any of the control valves do not open on a call for heating a warning shall be sent to the BMCS and the lag heat exchanger shall operate. The heating water supply temperature shall be reset proportionately to outside air temperature. The reset schedule(adjustable) shall be as follows:

Outdoor Temp(degF) (adj.)	Supply Temp.(degF) (adj.)
Below 0	140
Above 50	110

      f. When pumps are off, the normally-closed control valves shall be closed.
      g. Provide current switches for pump status.
      h. Main heating water supply and return temperatures shall be monitored.
      i. Provide flow meter downstream of pumps for monitoring.
      j. Contractor shall establish trend logs for the following points taking readings every 15 minutes:
         1) Outdoor air temperature.
         2) Heating hot water flow.

3) Heating supply and return temperature.
4) Pump operating speed(s).
5) Heat exchanger 1/12, 1/6, 1/3, and 2/3 valve position.

B. Air Handling Unit Preheat System:
1. Steam to hot water heat exchangers HX-2A and HX-2B with pumps GHWP-1A and GHWP-1B for air handling unit preheating water system (System has a 30% propylene glycol solution):
a. Each heat exchanger and pumps are sized for 100% capacity with one pump and heat exchanger redundant.
b. Variable frequency drive (VFD) for lead pump shall be enabled by the BMCS and shall run continuously. If lead pump fails to operate, VFD for lag pump shall be enabled and a warning shall be sent to the BMCS. Lead pump shall be alternated to ensure equal run time of pumps.
c. The speed of the pump shall be varied as required to satisfy differential pressure sensor. Sensor location shall be as follows:
1) 6th floor.
d. If differential pressure senor setting can not be met and the pump is at 100%, a warning shall be sent to the BMCS.
e. Steam control valves serving HX-2A and HX-2B are in a 1/12, 1/6, 1/3 and 2/3 arrangement. On a call for heating, the lead heat exchanger hot water isolation valve shall fully open and the 1/12 steam control valve shall modulate open to meet set point. If the 1/12 control valve is fully open and cannot maintain set point the 1/12 valve shall modulate closed and the 1/6 valve shall modulate open to maintain the set point. If the 1/6 control valve is fully open and cannot maintain set point the 1/6 valve shall modulate closed and the 1/3 and 2/3 valve shall modulate open in sequence to maintain discharge water set point per the reset schedule. Lead heat exchanger shall be alternated to ensure equal operation of heat exchangers. If any of the control valves do not open on a call for heating a warning shall be sent to the BMCS and the lag heat exchanger shall operate. The heating water supply temperature shall be reset proportionately to outside air temperature. The reset schedule(adjustable) shall be as follows:

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g. Provide current switches for pump status.
h. Main heating water supply and return temperatures shall be monitored.
i. Provide flow meter downstream of pumps for monitoring.
j. Contractor shall establish trend logs for the following points taking readings every 15 minutes:
1) Outdoor air temperature.
2) Heating hot water flow.
3) Heating supply and return temperature.
4) Pump operating speed(s).
5) Heat exchanger 1/12, 1/6, 1/3, and 2/3 valve position.

3.8 SMOKE DAMPER VERIFICATION

A. Provide each smoke and fire smoke damper with end switch to indicate position to BMCS. This is to verify proper damper position during fire alarm system testing and to alarm facility staff when smoke damper actuator fails. At installer's option, the actuator may be furnished with integral end switch. Coordinate with Section 23 31 13.

3.9 MISCELLANEOUS CONTROLS

A. Provide current switch for pump status for the domestic hot water recirculation pump, RCP-1.

B. For the domestic water booster system provided under 22 11 26, connect general alarm contact to BMCS.

C. For glycol feed systems specified under Section 232113, connect low level alarm contacts to BMCS for each system.

D. Provide high water alarm and pump failure alarm, with connection to BMCS, for steam condensate return pump CP-1.

E. The outside air temperature and humidity shall be monitored by the BMCS and used globally throughout the system. Where required, wet bulb temperature shall be calculated from these conditions.

3.10 DATA CONTROL (D/C) AND GRAPHICS

A. Provide all programming required to accomplish sequence of operations, including all data and control points not listed on input/output points summary shown on plans.

B. In addition to graphics of building systems with dynamic data points as noted in following data and control and graphic summary, and graphics required under digital system management sections, following additional graphics shall be provided:
   1. Building layouts (floor plans).
   2. Any other graphics necessary for logical penetration.
   3. Sequence of operation (window split screen view).
   4. Flow charts for critical DDC loops and existing building.
   5. Supervisor graphics.
   6. System configuration.
   7. Display VVR and CVR boxes, and reheat coil locations on building floor plans. This applies only to boxes specified with DDC control.
   8. Display fire and smoke damper locations on building floor plans.
   9. Display air handling unit locations and configuration (flow diagram, DDC Logic Diagram and control sequence).
   10. Display all DDC sensors, thermostats, and humidistats on floor plan corresponding to air terminal or other controlled device locations.
   11. Display all DDC panels, indexed to correspond with system configuration.

C. Include Pseudo points for display in logical groups and graphics. Commandable pseudo points to be commandable directly from all displays.

D. Each analog point to have unique remote panel resident dual high, and dual low limit alarm threshold engineering units. Where specified, provide floating (band above and below setpoint) alarm limits.

E. Each digital output to have software-associated monitored input. Anytime monitored input does not track its associated command output within programmable time interval, "command failed" alarm shall be reported.

F. Where calculated points (such as CFM) are shown, they shall appear in their respective logical groups. Respective unconditioned raw data (such as logarithmic differential pressure) points to also be grouped in special group for display and observation independent of logical groups.

G. Where data or control points are required to accomplish digital control or energy management sequences specified, but not listed in I/O summary, installer shall provide the points necessary to accomplish the specified sequence.

H. Primary analog input and analog output of each DDC loop to be resident in single remote panel containing DDC algorithm, and shall function independent of any peer or mux communication links. Secondary (reset type) analog inputs may be received from the peer network, but approved default values and/or procedures shall be substituted in DDC algorithm for this secondary input in network communications fail or if secondary input becomes erroneous or invalid.

3.11 INSTALLATION

A. All wiring and tubing to be properly supported, and run in neat and workmanlike manner. All wiring and tubing shall run parallel to or at right angles to building structure. All piping and wiring within enclosures to be neatly bundled, and anchored to prevent obstruction to devices and terminals.

B. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and pilot lights, push buttons and switches flush on cabinet panel face. ANSI/NEMA 250, general purpose utility enclosures with enameled finished face panel. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved nameplate on cabinet face.

C. Electrical wiring:
   1. BMCS installer: responsible for all electrical installation required for fully functional system, and not shown on electrical plans or required by electrical specifications.
   2. Code compliance: all local and national codes.
   3. Wiring size: #18 AWG minimum THHN, shielded where required by manufacturer or installation.
   4. Line voltage and low voltage control wiring installation: in conduit.
   5. Power supply:
      a. Power supply to all control devices are to be on UPS power. Coordinate with electrical engineer and electrical installer.
      b. BMCS installer: responsible for costs associated with installation of power supply from electrical panel to control device(s).

D. Identification:
   1. Provide laminated plastic nameplates for control panels. Other equipment devices furnished, including sensors, switches, valves, gages, actuators and all other item furnished under this section shall be identified with plastic embossed labels adhered to the device. Each nameplate shall identify the function, such as "mixed air low limit" or "cold deck temperature sensor" Laminated plastic shall be one-eighth inch thick whiter with black center core. Nameplates shall be a minimum of 1 inch by 3 inch with minimum one quarter inch high engraved block lettering. Nameplates for devices smaller than 1 inch by 3 inch shall be attached by a nonferrous metal chain. Submit proposed wording of each nameplate with hardware submittal.
   2. Instrumentation and Control Diagrams: Provide framed drawings including the sequence of controls and verbal description in laminated plastic showing complete diagrams for all equipment furnished and interfaces to all existing equipment, at each respective equipment location. Condensed operating instructions explaining preventive maintenance procedures methods of checking the system for normal safe operation and procedures for safely starting and stopping the system manually shall be prepared in typed form, framed as specified for the diagrams and posted beside the diagrams. Proposed diagrams, instructions and other sheets shall be submitted prior to posting.

E. BMCS installer to enter all computer programs and data files into related computers, including all control programs, initial approved parameters and settings, English descriptors, and colorgraphics complete with dynamic dispersed data. In addition, following to be user implemented, shall have samples installed for training and validation:
   1. Trend log.
   2. Alarm message (action taking message).
   3. Run time maintenance message.
   4. Trouble action message.
   5. Dynamic trend plot (6 points).

F. BMCS installer to maintain diskette copies of all data file, and application software for reload use in event of system crash or memory failure. One copy to be delivered to Owner during training session, and one copy archived at local software vault provided by BMCS manufacturer within 10 miles of OS.

G. Mount local control panels at convenient location adjacent to equipment served.
   1. Mount relays, PE switches, pressure switches, etc., on rear of temperature control panels. Tag each instrument by using "Dymo" tape corresponding to symbols used on control diagrams.

H. Locate panels so visual observation and adjustment can be accomplished from floor level.

I. Room sensors:
   1. Unless indicated otherwise, locate thermostats, humidistats and sensor for room control, and monitoring immediately inside of door adjacent to light switch.
      a. Where light switch is in an entry way to room, locate on wall within room so it is capable of sensing true space conditions.
      b. Prior to installation, coordinate locations with Architect/Engineer.
      c. Mount at 48 IN above finished floor.
   2. All room temperature and humidity sensors indicated in the control sequences shall be provided whether or not a location is indicated on the plans. If a location is not shown, allow for a maximum of 100 FT of wiring between the sensor and terminal unit or equipment. Submit Request for Information (RFI) to confirm sensor location with Architect.

3.12 VALIDATION

A. This project is conducted in many phases. Validation testing and documentation is required at the end of each phase to confirm that systems installed, amended or added to under the particular phase are operating properly.

B. Test Plans and Test Procedures Submittal: For each phase of construction, provide test plans, procedures for use in performing system functional testing.
   1. Deliver Test Plans and Procedures documentation for the performance verification tests to the owners representative no later than 30 days prior to the scheduled date of performance verification tests.
   2. Provide draft copy of operation and maintenance manual with performance verification test.
   3. Submitted Test Plans and Test Procedures shall include:
      a. Detail actions and expected results to demonstrate compliance with the requirements of this specification.
      b. Method for simulating the necessary conditions of operation to demonstrate performance of the system.

C. BMCS installer shall completely checkout, calibrate, and test all connected hardware and software to ensure that system performs in accordance with approved specifications and submitted sequences of operation. As directed by the Owner, calibration to be demonstrated by the BMCS installer in the presence of the Architect or Owner's representative. Should random sampling indicate improper commissioning, the owner reserves the right to subsequently witness complete calibration of the system at no addition cost to the owner.

D. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.

E. Validation Witness Testing and Reporting:
   1. After approval of validation test plans and procedures, contractor shall schedule validation testing with the Owner, Architect and appropriate local authorities after final balancing of the system. If work is phased construction, validation testing shall occur after each major phase of construction.
   2. Architect, Owner's representative and appropriate local authorities shall witness validation testing of all systems.

3. Make accessible, personnel to provide necessary adjustments and corrections to systems as directed by balancing agency.
4. Witnessed validation demonstration and associated report shall consist of:
    a. Demonstrate to authorities that all required safeties and life safety functions are fully functional and complete.
    b. Running each specified report and recording outcomes.
    c. Display and demonstrate each data entry to show site specific customizing capability. Demonstrate parameter changes.
    d. Step through penetration tree, display all graphics, demonstrate dynamic update, and direct access to graphics.
    e. Execute digital and analog commands in graphic mode.
    f. Demonstrate DDC loop precision and stability via trend logs of inputs and outputs (6 loops minimum).
    g. Demonstrate EMS performance via trend logs and command trace.
    h. Demonstrate scan, update, and alarm responsiveness.
    i. Demonstrate spreadsheet/curve plot software, and its integration with database.
    j. Demonstrate on-line user guide, and help function and mail facility.
    k. Demonstrate digital system configuration graphics with interactive upline and downline load, and demonstrate specified diagnostics.
    l. Demonstrate multi-tasking by showing dynamic curve plot, and graphic construction operating simultaneously via split screen.
    m. Demonstrate class programming with point options of beep duration, beep rate, alarm archiving, and color banding.
5. Contractor shall record the outcome of each test noting actual outcomes and discrepancies.
6. Submit detailed report of testing including all outcomes and deficiencies.

3.13 MANUALS (FOLLOWING MANUALS TO BE PROVIDED)

A. Functional design manual: The functional design manual shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. A description of hardware and software functions, interfaces, and requirements shall be provided for all system operating modes.

B. Hardware manual: Furnish a hardware manual describing all equipment provided including a general description and specification, installation and checkout procedures, equipment electrical schematics and layout drawings, system schematics and I/O wiring lists, and alignment and calibration procedures.

C. Software manual: The software manual shall describe all furnished software, starting with a system overview and proceeding to a detailed description of each software module. The manual shall be oriented to enable proper integration, loading, testing and program execution. Provide flow charts or diagrams or equivalent documentation, as approved in advance by owners representative, in hard copy enabling the logical step by step analysis of the program listings. Substitutions of different format are not acceptable.

D. Maintenance Manual: The maintenance manual shall provide descriptions of maintenance for all equipment including inspection, periodic preventative maintenance, fault diagnosis and repair or replacement of defective components.

END OF SECTION

DIVISION 26

ELECTRICAL

SECTION 26 00 10
ELECTRICAL GENERAL REQUIREMENTS

PART 1 - GENERAL

1.1 SUMMARY

A. Drawing use and interpretation:
   1. Drawings are diagrammatic and indicate general arrangement of systems and equipment, except:
      a. Specific installation details.
      b. When specific dimensions are indicated for electrical equipment it is intended that these be limiting dimensions. When proposed equipment exceeds these limiting dimensions, advise Architect. Features and functions of specified equipment shall not be superseded by these limiting dimensions.
   2. For exact locations of building elements, refer to dimensioned architectural/structural drawings.
   3. Field measurements take precedence over dimensioned drawings.
   4. Intention is to indicate size, capacity, approximate location, direction and general relationship of one work phase to another, but not exact detail or arrangement.
   5. Field verify locations and arrangement of all existing systems and equipment.

B. Installation of all systems and equipment is subject to clarification as indicated in reviewed shop drawings and field coordination drawings.

C. Description of systems:
   1. Provide materials to provide functioning systems in compliance with performance requirements specified.
   2. Provide modifications required by reviewed shop drawings and field coordinated drawings.

1.2 QUALITY ASSURANCE

A. Perform all work in accordance with but not limited to:
   1. Federal, state and local codes, regulations and ordinances.
   2. Underwriters Laboratories, Inc. (UL) requirements.
   3. NFPA-70 National Electrical Code (NEC).
   4. Occupational Safety and Health Act (OSHA).
   5. All authorities having jurisdiction.
   6. Factory Mutual System (FM) requirements.
   7. International Building Code (IBC).

1.3 SUBMITTALS

A. Contract Closeout Information:
   1. Final performance test reports.

1.4 DEFINITIONS

A. Weatherproof (WP): Indicates rating suitable for wet or damp location.

1.5 PROTECTION

A. Provide covering and shielding for all equipment to protect from damage.

B. Protect nameplates on motors and similar equipment, to prevent defacing.

C. Repair, restore or replace damaged, corroded and rejected items.

1.6 JOB CONDITIONS

A. Examine Contract Documents to determine how other work will affect execution of electrical work.

B. Make arrangements for and pay for necessary permits, licenses, and inspections.

C. Cause as little interference or interruption of existing utilities and services as possible.
   1. Schedule work which will cause interference or interruption in advance with Owner, Architect, authorities having jurisdiction and all affected trades.

D. Determine and verify locations of all existing utilities on or near site.

E. Temporary construction power and communications (See Division 01)

F. Record drawings:
   1. Keep a complete set of all electrical drawings in job site office for indicating actual installation of electrical systems and equipment.
   2. Use this set of drawings for no other purpose.
   3. Where any material, equipment, or system components are installed differently from that indicated, indicate differences clearly and neatly using ink or indelible pencil.
   4. At project completion, submit record set of drawings. Refer to Section 01 78 39 for specific requirements.

1.7 ENVIRONMENTAL CONDITIONS

A. General:
   1. Provide NEMA 1 enclosures for electrical equipment unless otherwise indicated.

B. Conduit: See Section 26 05 33.

C. Cable: See Section 26 05 19.

D. Boxes and Fittings: See Section 26 05 34.

E. Damp and wet locations:
   1. Exterior applications:
      a. Provide NEMA 3R enclosures for electrical equipment.

F. Corrosive environments:
   1. Use NEMA 4X reinforced fiberglass watertight enclosures in areas with corrosive atmospheres.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Use only prime quality, new materials, apparatus and equipment.

B. Material and equipment: Current and standard design of manufacturers regularly engaged in their production.

C. Where UL approval or listing is required in electrical specifications, suitable approval or listing from other nationally recognized testing laboratory (NRTL) is acceptable.

D. Use UL labeled electrical materials and fabricated assemblies.

E. Structural steel for supports: ASTM-A36.
   1. Galvanize members installed in areas of high humidity or condensation.
   2. Furnish other members with shop coat of rust inhibiting primer.
   3. Shop fabricate for field assembly using bolts.
   4. Minimize field welding.
   5. Retouch primer and galvanizing after field welding.

6. Unless support is otherwise indicated where weight of equipment exceeds 400 pounds, submit engineering design and calculations signed and sealed by a registered Engineer licensed to practice Structural Engineering in the state in which the project is located.

F. Rain hoods and counter flashings not exposed to view:
   1. Stainless steel: Minimum 20 GA.
   2. Sheet copper: Minimum 24 OZ.

G. Rain hoods and counter flashings exposed to view: As specified in Section 07 62 00.

H. Access doors, panels and frames: See Section 08 31 16.
   1. Provide where indicated on Drawings.
   2. Where not indicated on Drawings, provide access panels and/or doors at walls, and inaccessible ceilings as required to permit access to equipment, devices and piping requiring service, adjustment, or inspection.
   3. Size:
      a. As required to allow access, inspection, service, and removal of items served.
      b. Minimum 18 x 18 IN.

2.2 FIRESTOPPING

A. Maintain fire and smoke ratings where electrical items penetrate fire and fire/smoke rated building elements.

B. Use materials and methods as specified in Section 07 84 00.

PART 3 - EXECUTION

3.1 GENERAL

A. Use only thorough, highly skilled, and experienced personnel.

B. When changes in location of any work are required, obtain approval of Architect before making change.

C. Do not change indicated sizes without written approval of Architect.

D. Provide all necessary offsets and crossovers in conduits, raceways, cable trays and ducts.

E. Where electrical items penetrate fire and/or smoke rated walls, ceilings and floors, comply with Section 07 84 00.

3.2 CUTTING AND PATCHING

A. Provide cutting, fitting, repairing, patching and finishing of installed work.
   1. Include installed work of other sections where it is necessary to disturb such work to permit installation of electrical work.
   2. Repair or replace existing or new work disturbed.

B. Avoid cutting, where possible, by setting sleeves or frames, and by requesting openings in advance.

C. Before cutting, obtain approval of Structural Engineer.
   1. Use only approved methods.
   2. Cut all holes neatly and as approved by engineer possible to admit work.
   3. Do not weaken walls or floors; locate holes in concrete to avoid structural members.

D. Locate openings and sleeves to permit neat installation of conduits and equipment.

E. Do not remove or damage fireproofing materials.
   1. Install hangers, inserts, supports, and anchors prior to installation of fireproofing.
   2. Repair or replace fireproofing removed or damaged, at no extra cost.

F. See Section 01 73 29.

3.3 INSTALLATION OF EQUIPMENT

A. Install all equipment in accordance with manufacturer's recommendations.

B. Provide all necessary anchoring devices and supports.
   1. Use structural supports suitable for equipment.
   2. Check loadings and dimensions of equipment with shop drawings.
   3. Do not cut, or weld to, building structural members.
   4. Provide equipment supports even though not detailed on architectural and structural drawings.

C. Specifier: Add if seismic bracing is required. Be sure to include Section 26 05 48
   Brace and anchor equipment in accordance with Section 26 05 48
   Verify that equipment will fit support layouts indicated.
   1. Where substitute equipment is used, revise indicated supports to fit at no additional cost.

D. Arrange for necessary openings to allow entry of equipment.
   1. Where equipment cannot be installed as structure is being erected, provide and arrange for building-in of boxes, sleeves or other devices to allow later installation.

E. Make all penetrations through roofs prior to installation of roofing. For penetrations required after installation of roofing:
   1. In built-up roofing (BUR), provide all curbs, cants and base flashings.
   2. In elastic sheet roofing (ESR), arrange and pay for flashing work by authorized roofer.

F. Install rain hoods and metal counter flashings as indicated and make all penetrations of electrical work through walls and roofs water and weathertight.
   1. Furnish all clamps, waterproofing material and labor necessary.
   2. Where metal flashings are applied over concrete, paint concrete with 1/8 IN of mastic cement first.
   3. Set flashing in mastic cement, watertight.

G. Have repair and replacement of roof construction, damaged by this work, done in manner which will not nullify roof warranty.

H. Install equipment to permit easy access for normal maintenance.
   1. Maintain easy access to switches, motors, drives, pull boxes, receptacles, etc.
   2. Relocate items which interfere with access.

I. Provide concrete foundations (isolation pads) or housekeeping pads for floor mounted electrical equipment as follows unless otherwise indicated:
   1. Install nominal 4 IN high concrete housekeeping pads. Outside dimension of pad shall be at least 4 IN larger in all directions than base of equipment or 228 mm 9 IN from center of anchor, whichever is greater.
   2. Use 3,000 PSI concrete.
   3. Reinforce with No.4 12 IN OC each way, with short No.4 dowels into floor at 24 IN OC each way.
   4. Chamfer top edges 3/4 IN.
   5. Make faces smooth.
   6. Set anchor bolts for equipment.

J. Provide security fasteners on all light fixtures, device plates, etc., in inmate areas within secure perimeter.
   1. "Tampruf" hardened steel.

3.4 PAINTING

A. See Section 09 91 13, and Section 09 91 23.

3.5 REMODELING

A. Field verify locations and arrangement of all existing systems and equipment.

B. Where relocation of existing equipment and piping systems is necessary in areas providing services that must remain in operation, schedule work for minimal down time during slack period.
   1. Anticipate scheduling work during premium time and include cost in proposal.

C. Do not cut into existing services without first verifying with Owner that service has been correctly identified.
   1. Perform work that interrupts any service during premium time.
      a. Include cutting into existing lines for new connection.
      b. Cause least interference to normal operation of building.
   2. Inform building engineering staff in advance of any shut off that will occur and give estimate of duration.
   3. Begin work only after engineering staff is fully informed and has agreed to schedule of shut offs.

D. Fabricate and install interconnecting portions of these systems prior to shut down for final connections.

E. Maintain all existing services and equipment unless indicated to be removed.

F. Perform demolition as directed by Contractor.
   1. Remove all equipment indicated.
   2. Relocate items indicated after thorough cleaning.
   3. Remove all existing wiring serving abandoned circuits.
   4. Remove all non-embedded conduit serving abandoned circuits.

G. Salvage items in accordance with Section 02 41 00.

H. Existing conduit and wire of proper sizes may be spliced and extended from appropriate points, but do not reuse after removal.

I. Existing equipment and materials removed from existing construction and not indicated or required to be reused shall become the property of the Owner, if they so elect.
   1. Present equipment and materials removed to Owner's representative, who shall select equipment and materials to retain.
   2. Equipment and materials not retained shall become property of Contractor and shall be removed from site.

3.6 FIELD QUALITY CONTROL

A. Perform indicated tests to demonstrate workmanship, operation, and performance.
   1. Conduct tests in presence of Architect and, if required inspectors of agencies having jurisdiction.
   2. Arrange date of tests in advance with Architect, manufacturer and installer.
   3. Give minimum of 24 hours notice to all inspectors.
   4. Furnish or arrange for use of electrical energy, steam, water, diesel fuel, or gas required for tests.
   5. Furnish all lubricating materials required for test.

B. Repair or replace equipment and systems found inoperative or defective and retest.
   1. If equipment or system fails retest, replace it with products conforming with Contract Documents.
   2. Continue remedial measures and retests until satisfactory results are obtained.

C. Test equipment and systems as indicated for each item, unless otherwise recommended by manufacturer.

3.7 FINAL PERFORMANCE TEST

A. Perform panel load balance, short circuit, and freedom from ground, and ground test (including ground fault protection where provided).
   1. As part of putting systems in operation, provide tabulated results of load balance and voltage at each switchboard, panelboard and motor control center. Use true RMS measuring metering devices.
   2. Provide written report that all circuits have been energized and no short circuits exist.
   3. Provide neutral to ground resistance tests to prove neutral is grounded in only one location.
   4. Provide ground test at service entrance and provide report on resistance to earth of the grounding electrode system.

3.8 ADJUST AND CLEAN

A. Inspect all equipment and put in good working order.

B. Clean all exposed and concealed items.

C. Where new work occurs in existing areas where no other work has been done, clean area and restore to original condition.

3.9 PUTTING SYSTEMS IN OPERATION - START UP

A. Put all systems into satisfactory operation prior to final acceptance, at time agreed to by Contractor, Owner and Architect.

B. Operate all systems in good working order for period of 5 working days.

3.10 DEVICE MOUNTING

A. See symbol legend for devise mounting heights unless otherwise noted.

B. Dimensions are to center of device unless otherwise indicated.

C. Coordinate device locations with all equipment/furnishings abutting walls such as, but not limited to, architectural millwork, casework, lockers, mirrors, and equipment. Refer to architectural and casework/equipment elevations to facilitate coordination of device placement. Devices shall be relocated at Contractor's expense if conflict exists after installation.

D. Coordinate device mounting height with wainscoting, tile, tile patterns, and wood where provided. Coordinate device location and shift if needed to work with elevations.

E. Device Mounting Schedule:
   1. Mounting heights as indicated below unless noted otherwise on the drawings:

Flush tumbler switch 48 IN
Dimmer switch 48 IN
Receptacle (in offices and corridors) 18 IN
Receptacle above counter 4 IN above backsplash or 4 IN above work surface if no backsplash provided unless otherwise indicated.
Receptacle (in mechanical equipment rooms) 48 IN
Receptacle for electric water cooler, center vertically and horizontally behind unit
GFCI receptacle in bathrooms and toilets
Telephone outlets for desk phone 18 IN
Telephone above counter Locate outlet 4 IN above backsplash or 4 IN above work surface if no backsplash provided unless otherwise indicated.
Fire alarm manual pull station 48 IN
Fire alarm notification device 80 IN above highest floor level within space (from bottom of faceplate) or 6 IN below the ceiling (from bottom of faceplate), whichever is lower. Fire alarm notification devices shall be wall mounted unless otherwise indicated.
Safety switch 54 IN

Panelboard (to top) 72 IN

3.11 IDENTIFICATION AND LABELING

A. Nameplates: Provide engraved laminated nameplates with white lettering for electrical equipment.
   1. Provide black nameplate(s) for equipment fed by normal distribution system.
   2. Coordinate color(s) of emergency system name plates with painting paragraph below.
   3. Letters:
      a. 1/4 IN high for equipment with cover plate under 12 IN wide.
      b. 1/2 IN high for equipment with cover plate over 12 IN wide:
   4. Attach with stainless steel screws.
   5. Switchgear, switchboard, distribution panel and motor control center nameplates:
      a. Center nameplate near top of first section. Label text to include:
         1) Equipment name and branch, i.e., "Panel XXXX - Life Safety Branch".
         2) Source, i.e., "Source - Switchboard XXXX".
      b. Provide similar nameplates for each main and feeder device. Mount label adjacent to or on cover of device. Label text to include:
         1) Description of load, i.e., "Load - Panelboard XXX".
   6. Panelboard nameplates:
      a. Center nameplate near top of each section. Lable text to include:
         1) Equipment name and branch, i.e., "Panel XXXX - Life Safety Branch".
         2) Source, i.e., "Source - Switchboard XXXX".
   7. Disconnect switches, transformers, contactors, thermal element switches, starters, capacitors, etc. nameplates:
      a. Center nameplate near top of face plate or cover. Lable text to include:
         1) Description of load, i.e., "Load - AHU-XXX".
         2) Source, i.e., "Source - MCC-XXXX".
   8. Transfer switches:
      a. Center nameplate near top of cover. Label text to include:
         1) Description of load, i.e., "Distribution Board XXXX - Life Safety Branch".
         2) Normal source, i.e., "Normal Source - Switchboard XXXX".
         3) Emergency source, i.e., "Emergency Source - Switchboard XXXX".
   9. Fire alarm, public address and other system control cabinet nameplates:
      a. Center nameplate near top of cover. Label text to include:
         1) Description of system, i.e., "Fire Alarm System Control Panel".
   10. Relays and relay cabinet nameplates:
      a. Center nameplate near top of cover. Label text to include:
         1) Description of item controlled, applicable system or function and type of device, i.e., "AHU-XXX FA Shut Down Relay" or "Exterior Lighting Circuit XX-X Control Relay".

B. Flash hazard warning signs: Provide for all switchboards, panelboards, and motor control centers per NEC Article 110.

C. Device plates: See Section 26 27 26.

D. Paint outlet boxes, junction boxes and enclosures, except switchboard and panelboard enclosures, for emergency circuits as follows:
   1. Fire Alarm System: Red.
   2. Emergency System: Yellow.

E. Paint all emergency system feeder conduits with 2 IN wide band 10 FT on center as scheduled in paragraph(s) above.
   1. Pressure-sensitive, color-impregnated tape will be acceptable.

F. High voltage signs:
   1. All distribution equipment rated over 600 volts and/or pull and junction boxes containing conductors rated over 600 volts shall have a sign posted on the front and rear as applicable:

a. 1 to 1-1/2 IN high red letters stenciled on a 3 IN high white background.
b. Sign shall read, "DANGER -- HIGH VOLTAGE".

END OF SECTION

SECTION 26 00 11
WIRING EQUIPMENT FURNISHED BY OTHERS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide all conduit, wiring, outlet boxes, receptacles, circuit breakers, fittings, switches, starters, (with overloads) etc., to make final connections to all equipment.

B. Connect:
   1. Heating, ventilation, cooling and plumbing system equipment, (Mechanical Specification Divisions).
   2. Automatic door equipment, (Division 08).
   3. Electronic security equipment, (Division 28).

C. Completely coordinate with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. MECHANICAL SPECIFICATION DIVISIONS EQUIPMENT
   1. Provide all conduit, wire, and connect all Mechanical Specification Divisions equipment.
   2. Provide all motor starters except in package or prewired units as indicated in Mechanical Equipment Schedule.
      a. Connect all motors.
      b. Provide starters with thermal overload protection for all motors not having such protection, except as otherwise indicated.
      c. Starters: See Section 26 24 19.
   3. Provide proper thermal overload heater elements in all starters.

B. AUTOMATIC DOOR EQUIPMENT
   1. Provide all conduit, wiring, outlet boxes, etc., to make final connections to all motors, switches, safety mats, proximity detectors, remote control units, electric dead bolts.
   2. See Division 28 for connections to fire alarm system.
   3. Switches for control of automatic doors provided by door manufacturer, installed by electrical.

C. DIVISION 28 ELECTRONIC SECURITY SYSTEMS
   1. Provide complete raceway system, minimum size conduit 3/4 IN, from main head end equipment to the end device, including any necessary standard size backboxes, wireways, junction boxes, pullboxes and manholes.
   2. Provide all 120 volt AC power wiring and connections to electronics systems UPS equipment.
   3. Provide heavy duty nylon pull string or wire in all conduit suitable for use in pulling in wire.
   4. Division 28 installer: Furnish conduit requirements and special backboxes to the Electrical Specifications Divisions installer.
   5. Division 28 installer: Provide additional conduits required (not shown on drawings) or increase in size of conduit to effect the installation of the Division 28 equipment.
   6. Refer to Division 28 and to electronic security drawings, Series “DE” drawings.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Perform work in accordance with applicable Electrical Specifications Divisions.

B. Wire equipment complete properly connected and energized.

C. Provide conduit and wiring as required for directly-connected switches as indicated or required.

END OF SECTION

SECTION 26 05 19
LOW VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Low Voltage Electrical Power Conductors and Cables, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Splices and taps for smaller than No.6 AWG wire:
   1. Base:
      a. 3M.
      b. Ideal Electric.
      c. Heyco Molded Products.
      d. Elastimold.
      e. Buchanan Construction Products.
   2. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Wire for 600 volts and below: Single conductor, soft drawn, copper wire with 600 volt insulation, UL listed.
   1. For feeders and branch circuits: Type THWN/THHN or XHHW.
   2. Use no wire smaller than No.12 AWG, except as follows:
      a. Smaller size wire may be used only where specifically indicated.
      b. No.14 AWG may be used for pilot control and signal circuits.
   3. Size conductors to match over current protective device unless larger conductors are indicated.
   4. No. 10 AWG conductor to be used for 20 ampere, 120V circuits exceeding 100 FT.
   5. No. 10 AWG conductor to be used for 20 ampere, 277V circuits exceeding 200 FT

B. Splices and taps for smaller than No.6 AWG wire:
   1. 3M, "Scotchlok" or "Hyflex".
   2. Ideal "Wingnut" or "Wirenut".
   3. Heyco.
   4. Elastimold insulated conical spring-type connectors.

C. Splices and taps for No.6 AWG wire and larger: Use compression connectors with prestretched insulation to equal insulation of wire being spliced.

D. Splices and taps - General: Do not make splices and taps with crimp or indenter-type connectors.

E. Pulling lubricant: Do not use cable pulling lubrication compound containing petroleum or other products which may deteriorate insulation.

F. Color coding: Color code all conductors in accordance with NEC as follows:
   1. Color code all wiring.
   2. Use following colors in lighting and power wiring:

	120/208 VOLT	277/480 VOLT
Phase 1	Black	Brown
Phase 2	Red	Orange
Phase 3	Blue	Yellow
Neutrals	White	Gray
Ground	Green	Green

3. Isolated equipment grounding conductor: Green with one or more yellow stripe(s).
4. Color coding of ends only will be acceptable for feeder phase conductors.
5. Color coding of ends only will be acceptable for neutral and grounding conductors number 4 AWG and larger.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Lighting and receptacle home runs indicated are for identification purposes only.

B. Install all line voltage wiring in conduit unless otherwise indicated.

C. Install no more than 3 phase conductors in one conduit. This excludes ground wire. The neutral conductor shall be considered as a current carrying conductor.

D. Provide a separate neutral conductor for each phase conductor in all receptacle and appliance branch circuits.

E. Run panelboard and motor feeders in individual conduits.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Grounding and Bonding for Electrical Systems, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Product Data:
   1. Technical data on connectors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Exothermic weld kits:
   1. Base:
      a. Cadweld.

B. Compression fittings:
   1. Base:
      a. Burndy.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Wire and cable: See Section 26 05 19.
   1. Main ground: Copper conductor, sized as required by appropriate service grounding conductor table of NEC.
   2. Grounding copper conductor for non-metallic conduit and ducts: Copper bar or insulated conductor, sized in accordance with NEC or as indicated.

B. Conduit: See Section 26 05 33.

C. Grounding clamp connections: Clean contact surfaces, tinned and sweated during bolting.

D. Grounding type insulated bushings: See Section 26 05 33.

PART 3 - EXECUTION

3.1 GENERAL

A. Ground all neutral conductors, conduit systems, cabinets, equipment, motor frames, etc., in accordance with NEC and applicable codes.

B. Locate neutral ground disconnecting link or links in main switchboard so that low-voltage neutral bar with all interior secondary neutrals can be isolated from common equipment grounding bus.

3.2 DISTRIBUTION

A. Make all metallic raceway fittings and grounding clamps tight to insure that equipment grounding system will operate continuously at ground potential to provide low impedance current path to insure proper operation of overcurrent devices during possible ground fault currents.

B. Do not solder grounding circuit connections.

C. Where metallic conduits terminate without mechanical connection to metallic housing (switchboards, motor control centers, etc.), provide each conduit with grounding type insulated bushing.
   1. Connect each bushing to grounding bus in equipment with bare copper conductor.

D. In nonmetallic conduits or ducts maintain continuity of equipment grounding system by bar or conductor installed and connected by approved method to conductive noncurrent-carrying equipment at both ends.

E. Ground all conduit, panelboards, receptacles, accessible fixtures, switchgear, transformers, motors and motor equipment.

F. Make ground continuity positive throughout entire project.

END OF SECTION

SECTION 26 05 33
CONDUITS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Conduits, as indicated, in accordance with provisions of Contract Documents.

B. Conduit runs are diagrammatic. Verify and coordinate locations in field.

C. Completely coordinate with work of other trades.

1.2 SECTION INCLUDES

A. Rigid Metal Conduit (RMC).

B. Intermediate Metal Conduit (IMC).

C. Electrical Metallic Tubing (EMT).

D. Flexible Metal Conduit (FMC).

E. Liquidtight Flexible Metal Conduit (LFMC).

F. Thinwall plastic conduit.

G. Conduit fittings.

H. Expansion fittings.

I. Inserts and attachments.

J. Supports, sleeves and seals.

1.3 QUALITY ASSURANCE

A. Regulatory Requirements:
   1. Electrical Components, Devices, and Accessories shall be listed and labeled in accordance with NFPA 70, Article 100, by testing agency acceptable to authorities having jurisdiction, and marked for intended use.

B. Certifications:
   1. Conduit: Stamp each length with name or trade mark of manufacturer and affix UL label.

1.4 SUBMITTALS

A. Shop Drawings:

B. Product Data:
   1. Manufacturer's data for each product specified.
   2. IBC Certificates of Compliance.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. As noted for each type listed below.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. RIGID METAL CONDUIT (RMC):
   1. Acceptable Manufacturers:
      a. Base:
         1) Allied Tube and Conduit Corp.
      b. Optional:
         1) Republic Conduit.
         2) Wheatland Tube.
   2. Materials
      a. Hot dipped galvanized, or sherardized, including threads.
      b. Standard pipe thread with coupling; deliver with thread protector and end caps.
      c. Standards:
         1) NEMA/ANSI C80.1 – Electrical Rigid Steel Conduit – Zinc Coated (ERSC).
         2) UL 6 - Electrical Rigid Metal Conduit – Steel.

B. ELECTRICAL METAL TUBING (EMT):
   1. Acceptable Manufacturers:
      a. Base:
         1) Allied Tube and Conduit Corp.
      b. Optional:
         1) Republic Conduit.
         2) Wheatland Tube.
   2. Materials
      a. Electrical Metal Tubing (EMT): Galvanized steel of thin wall thickness.
      b. Factory colored EMT may be used, if desired, for all conduits 1” and below. Follow Owner standard color identification.
      c. Standards:
         1) Nema/ANSI C80.3 –Steel Electrical Metal Tubing (EMT).
         2) UL 797 - Electrical Metallic Tubing – Steel.

C. FLEXIBLE METAL CONDUIT (FMC):
   1. Acceptable Manufacturers:
      a. Base:
         1) Anamet Electrical
      b. Optional:
         1) Electri-Flex.
         2) AFC.
         3) International Metal Hose.
   2. Materials
      a. Flexible Metal Conduit (FMC): Steel, hot dipped galvanized.
      b. Standards:
         1) UL 1 – Standard for Flexible Metal Conduit.

D. LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC):
   1. Manufacturers based on specification compliance:
      a. Base:
         1) Anamet Electrical
      b. Optional:
         1) Electri-Flex.
         2) AFC.
         3) International Metal Hose.
   2. Materials
      a. Liquidtight Flexible Metal Conduit (LFMC): Steel, hot dipped galvanized with PVC jacket.
      b. Standards:
         1) UL 1660 – Standard for Liquid-Tight Flexible Nonmetallic Conduit.

E. CONDUIT FITTINGS:
1. Acceptable Manufacturers:
   a. Base:
      1) Appleton Electric.
   b. Optional:
      1) Cooper Crouse-Hinds.
      2) Killark.
      3) Thomas & Betts.
      4) O-Z/Gedney.
2. Materials
   a. Standards:
      1) ANSI/NEMA FB-1 – Fittings, Cast metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
      2) UL 514B - Conduit, Tubing, and Cable Fittings.
   b. RMC Fittings
      1) Threaded cast ferrous alloy with corrosion resistant finish. Cast body with gasketted corrosion resistant screw cover and threaded hubs.
      2) Not Approved: Zinc alloy and similar soft metal die castings.
   c. EMT Fittings:
      1) Steel compression-ring type .
      2) Set screw type fitting with steel body and cup type screws.
   d. FMC Fittings:
      1) Dry locations: Squeeze type, malleable iron, cadmium plated, straight and angle connectors for all sizes except twist-in connectors for 19mm 3/4 IN and below flexible metal conduit.
      2) Damp or wet locations: liquid-tight connectors.
   e. Bushings:
      1) Threaded, galvanized, malleable iron.
      2) Bushings for conductors No.4 and larger: Separate insulated bushings.
         a) Do not use insulated throat connectors.
      3) Grounding bushings: With screw termination for green grounding wire.

F. EXPANSION FITTINGS:
1. Acceptable Manufacturers:
   a. Base:
      1) Cooper Crouse – Hinds
   b. Optional:
      1) O-Z/Gedney
      2) Appleton Electric.
2. Materials
   a. Description:
      1) Watertight deflection type cast slip joint fitting for conduit, with flexible bonding conductor for continuity of ground through metallic conduit.
   b. Design Standards:
      1) O-Z/Gedney: Type DX.
      2) Cooper Crouse – Hinds: Type XJG.

G. INSERTS AND ATTACHMENTS:
1. Select inserts and attachments to suit loading conditions.
   a. See Section 01 31 11 for load limitations where more than one trade may be applying loads to device.
2. Inserts For Placement in Concrete Formwork:
   a. Malleable iron, wedge with nut, galvanized finish.
   b. Size inserts to suit threaded hanger rods.
3. Attachments to Existing Construction:
   a. Malleable iron, wedge, galvanized finish.

4. Use plastic toggles where securing directly to drywall.
5. Attachments to existing construction are not permitted. See support details.

H. SUPPORTS, SLEEVES AND SEALS:
1. Conduit supports:
   a. Standards:
      1) UL 2239 - Hardware for the Support of Conduit, Tubing, and Cable.
      2) Listed and in compliance with other applicable standards.
   b. Designed specifically for electrical installations.
   c. Hangers:
      1) Steel cadmium plated threaded rods with straps or clamp conduit holder.
   d. Straps:
      1) One-hole and two-hole malleable iron, hot-dipped galvanized or steel, cadmium or zinc plated.
   e. Beam Clamps:
      1) Malleable iron, hot-dipped galvanized or cadmium plated.
   f. Channels and Fittings:
      1) Channels: Hot-dipped galvanized.
      2) Fittings: Galvanized.
   g. Trapeze assemblies:
      1) Constructed from channels and supported by at least two (2) threaded rods attached to building structure.
   h. Do not use following to support conduit:
      1) Wire including ceiling support wires.
      2) Perforated strap hangers.
      3) Plastic or nylon tie wraps.
2. Sleeves:
   a. Black iron pipe, RMC or IMC sized to accommodate work passing through.
3. Sealer for sleeves and openings around conduit:
   a. UL listed for assembly.
   b. See Section 07 84 00.
4. Sealer for use inside conduits:
   a. Acceptable Manufacturers:
      1) Base:
         a) Arnco.
      2) Optional:
         a) Polywater .
   b. Materials
      1) Description:
         a) Watertight / Air tight foam sealant for electrical conduit.
         b) Listed for application with electrical wiring and conduit.
      2) Design Standards:
         a) Arnco: Hydra-Seal.
         b) Polywater: FST Duct Sealant.

PART 3 - EXECUTION

3.1 SCHEDULE OF CONDUIT UTLIIZATION

A. Use no conduit smaller than 3/4 IN.

B. Thinwall non-metallic conduit shall only be used for concrete encasement and not be smaller than 50mm 2 IN.

C. Size conduit in accordance with NEC unless indicated larger.

D. Rigid Steel Conduit (RMC) or Intermediate Metal Conduit (IMC) shall be used in following locations unless otherwise noted:
   1. Outdoors Exposed.
   2. In exterior masonry walls.
   3. In wet locations.
   4. For exposed interior runs below 10 FT above finished floor unless otherwise indicated.
   5. For feeders over 600 volts.
   6. In explosion-proof areas.

E. Use PVC coated steel conduit in corrosive areas as noted.

F. EMT shall be used for other 600 volt and below dry applications as follows:
   1. Concealed in walls or above finished ceilings.
   2. Exposed EMT may be used below 3050mm 10 FT level in following locations:
      a. From floor to ceiling in electrical equipment rooms.
      b. Directly above motor control centers in locations other than electrical equipment rooms.
      c. Directly above junction boxes or control panels associated with elevators or mechanical equipment with conduit termination point of 6 FT or more above floor.

G. Flexible steel conduit:
   1. For connection to equipment subject to vibration.
   2. Use liquid-tight flexible conduit for applications, including but not limited to:
      a. All damp and wet locations.
      b. Dietary production and dishwashing areas.
      c. Mechanical pumps.
      d. Laboratory casework.
   3. For connection to lighting fixtures above suspended ceilings.
   4. In listed office furnishings.
   5. In architectural millwork and casework.
   6. Where fished into existing walls or ceilings, not otherwise accessible and not subject to physical damage.

H. PVC conduit may be used subject to following:
   1. Do not use exposed PVC conduit unless otherwise noted.
   2. Provide a 600 volt, insulated, green grounding conductor in each PVC conduit.
      a. Power circuits: Proper ampacity per NEC.
      b. Communications circuits: No.12 AWG minimum.
   3. 45 DEG and greater bends in PVC conduit runs shall be made with rigid steel conduit.
   4. Schedule 80 PVC conduit may be used for grounding electrode system and telecommunications ground backbone runs below and above grade and stubs through concrete slabs on grade.
   5. Direct burial Schedule 40 PVC or concrete encased Type EB may be used as follows:
      a. Exterior Lighting: See Section 26 56 00.
      b. Underground Ducts and Raceways for Electrical Systems: See Section 26 05 43.
      c. Voice and data systems where underground and in or under concrete slabs on grade.
      d. Underground and concrete encased conduits over 600 volts.

3.2 INSTALLATION

A. Unless otherwise noted install all conduits concealed within walls and above finished ceilings.

B. Do not run horizontally in CMU.

C. Apply Appleton TLC or T and B Kopr-Shield joint compound to conduit threads where installed underground or exposed to weather.

D. Provide separate conduit systems for telephone, exit signs, fire alarm, emergency lighting, and other communications systems, unless otherwise indicated.
   1. Separate systems of different voltage classes into different conduit systems unless otherwise noted.

2. Provide dedicated junction boxes and pull boxes to separate wiring systems.
3. Do not combine 208/120 and 480/277V wiring in common wireways or pull boxes.
4. Keep communications systems separated.

E. Where practical, group homeruns to same panelboard.
1. Do not enclose more than three single phase circuits or one three phase circuit in one raceway unless noted otherwise.
2. Exposed overhead conduit may be used in mechanical, electrical and other equipment rooms except conduit drops to following:
3. Where finished walls are provided, conduit drops to wiring devices, fire alarm devices, telecommunications outlets and other flush mounted devices shall be concealed within finished walls.

F. Run non-buried conduit in straight lines at right angles to or parallel with walls, beams or columns.

G. Keep conduit away from uninsulated hot water and steam pipes.
1. Where crossings are unavoidable, leave minimum 6 IN clearance.

H. Avoid running conduits underneath water lines except for crossings.

I. Do not cross conduit in front of access door in HVAC duct.

J. Only nylon or polyethylene rope shall be used to pull wire and cable in conduit systems.

K. Provide conduit support designed for building structural conditions to carry load imposed.

L. Provide inserts or fasteners to attach hangers to structure.
1. Do not use drilled or explosive driven inserts in precast-prestressed concrete construction.
2. Drilled or explosive driven inserts may not extend more than 1 IN into post-tensioned concrete construction.
3. Attachment to metal roof deck may be by means of prepunched tabs, prepunched holes, or with screws in sides of ribs or toggle bolts in bottom of ribs.
4. Space hangers in joints between precast units minimum 4 IN from walls.

M. Protect inside of conduit from dirt and debris during construction by capping openings with tapered plugs or plastic caps.
1. If moisture or debris gets into conduit remove before wire is drawn into place.

N. Make conduit field cuts square and ream to full size.
1. Shoulder conduit in couplings.

O. Use trapeze assemblies to support multiple conduits.
1. Coordinate layout to provide adequate access to cable tray assemblies if applicable.

P. Installation of conduit or rack of conduits shall not interfere with placement of specified luminaire.

Q. Hangers in roof deck:
1. Do not extend above tops of ribs, or otherwise interfere with vapor retarder, insulation or roofing.

R. Support conduit systems from building structure or walls with approved hangers.
1. Provide seismic bracing as required.
2. Do not support from piping, ducts or support systems for piping or ducts.
3. Do not support from ceiling or ceiling support systems.
4. Do not install to prevent ready removal of equipment, piping, ducts or ceiling tiles.

S. Do not install conduit under pads for fans, pumps, boilers, or other machinery.

T. Seal and waterproof penetrations of floor slab at mechanical rooms above grade.
1. Where required, provide firestop systems in accordance with Section 07 84 00.

U. Conduit shall not be installed in structural elements, i.e. concrete columns, beams, decks, or slabs unless otherwise noted.

V. Sum of angles in any conduit run shall not exceed 360 degrees.
   1. Install conduit body, junction box or pull box where additional bends are necessary.
   2. Install pull boxes every 100 FT in long conduit runs.
   3. Conduit body, junction box and pull box covers shall be accessible.
   4. Conduit bodies may be used as follows:
      a. On exposed runs at junctions, bends or offsets where splices are not required.
      b. Around outside corners of walls and equipment or around beams.
   5. Conduit bends:
      a. Make field bends with tools designed for conduit bending.
         1) Heating of metallic conduit to facilitate bending is not permitted.
      b. Hand conduit bender may be used on 3/4 IN RMC, IMC or EMT conduit and 1 IN EMT conduit.
         1) Use conduit bending machine for larger sizes.
      c. Make no bends with radius less than 12 times diameter of associated cable.
      d. No conduit bends shall not exceed 90 DEG.

W. Support suspended conduits within 300mm 12 IN of any change of direction of 45 DEG or greater.

X. Make joints in threaded conduit watertight with white nonleaded compound applied to male threads only.
   1. Cut square, ream smooth, and properly thread field joints to receive couplings.
   2. Do not use running threads.

Y. Neatly seal openings around conduits, etc., where they pass through fire rated construction or exterior walls or roof. Provide proper rated seal for fire-rated penetrations.

Z. Conduit passing through concrete wall or slab penetrations:
   1. All core drilling, sleeves, block-outs or other penetrations must be approved by Structural Engineer prior to installation.
   2. Space sleeves and core drills to insure minimum of three (3) times nominal trade diameter of largest adjacent conduit between sleeves or core drills.
   3. Use block-outs for concentrations of conduits in confined area.

AA. No exterior horizontal roof supported conduit runs are permitted in lengths exceeding 6 FT unless indicated otherwise,.

BB. Empty conduits:
   1. Install 5mm 3/16 IN minimum diameter polypropylene or nylon pull-line from end to end with tag at each end designating opposite terminus.

CC. Conduit stub-outs:
   1. Extend conduit stub-out to 1 6 IN above nearest accessible ceiling outside room where outlet is located.
   2. Terminate conduit with insulating bushing.

DD. Conduits stubbed into manholes:
   1. Terminate metal conduit with insulating bushing.
   2. Terminate non-metallic conduit with bell ends.

EE. All conduit stub-outs on site shall be identified in one of following ways and noted on as-built drawings provided to Owner:
   1. Permanently marked.
   2. Dimension from landmark on site or building.
   3. Using a Global Positioning System (GPS) device accurate to within 6 IN.

3.3 INSTALLATION - EMPTY CONDUITS

A. Arrange empty conduits for easy installation of future cables.
   1. Cap conduits in accessible locations.

B. Provide a draw line in each empty conduit, tagged at each end with identification and location of other end.
   1. For draw line, use manufactured fish tape, 200 LB test nylon line, or other approved means.

3.4 INSTALLATION - CONNECTIONS AND FITTINGS

A. Install rigid conduits squarely into boxes.
   1. Rigidly clamp to box with locknut on outside and inside and provide bushing on inside.

B. Fit all conduit ends at switch and outlet boxes with approved lock nuts and bushing forming approved tight bond with box when screwed tightly in place.

C. Above lay-in tile ceilings, make connections to lay-in type fixtures with flexible steel conduit no longer than 6 FT.
   1. Arrange conduit and box systems for easy removal of lay-in ceiling.

D. Connect switch legs for narrow switches in hollow metal jamb posts using 1/2 IN flexible steel conduit.

E. Make motor and equipment connections with flexible steel conduit in dry areas and liquid-tight for damp and wet locations, not exceeding 24 IN length.

F. Provide expansion joint fittings as follows:
   1. On conduit at all building expansion or control joints where conduit is rigidly attached to structure.
   2. Where necessary to compensate for thermal expansion and contraction.
   3. Flexible metal conduit may be used for expansion fittings on runs smaller than 1 IN where exposed, or concealed above suspended ceilings.
      a. Leave slack in conduit for movement.
      b. Fasten on each side of joint.

G. Provide junction box with ductseal on raceways subject to different temperatures including but not limited to:
   1. Conduits passing from interior to exterior of structure.
   2. Conduits serving cold storage rooms, freezers and refrigeration equipment.

H. Provide sealing fittings on rigid galvanized conduit in hazardous areas and install in accordance with NEC.

I. When roof exhaust fans are equipped with housing conduit entries and integral disconnects, install conduit to roof exhaust fans through fan housing with no conduit exposed.

END OF SECTION

SECTION 26 05 34
BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Boxes, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Reference Standards:
   1. UL 514A – Metallic Outlet Boxes.
   2. ANSI/NEMA FB-1 – Fittings, Cast metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable.
   3. ANSI/SCTE 77 Specification for Underground Enclosure Integrity.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Dimensioned drawings indicating locations of all floor boxes and poke-thru assemblies.

B. Product Data
   1. Describe configurations, finishes, colors, and dimensions for all of following:
      a. Floor boxes.
      b. Poke-through assemblies.
      c. Provide IBC Certificates of Compliance

PART 2 - PRODUCTS

2.1 OUTLET BOXES

A. Acceptable Manufacturers:
   1. Galvanized boxes and fittings:
      a. Base:
         1) Emerson Industrial – Appleton Electric
      b. Optional:
         1) Thomas & Betts –Steel City
         2) Hubbell Electrical Products - RACO
   2. Corrosion resistant and wet location boxes and fittings:
      a. Base:
         1) Thomas & Betts (Ocal)
      b. Optional:
         1) Robroy
   3. Box supporting brackets:
      a. Base:
         1) Erico/Caddy
   4. Other manufacturers desiring approval comply with Section 00 26 00.

B. Requirements:
   1. Minimum Size:
      a. 4 IN square or octagon.
      b. Depth as required.
   2. Lighting outlet boxes:
      a. Galvanized.

b. Use extension and plaster rings as required.
c. Verify proper depth with partition thickness.
d. Provide with proper fittings to support and attach lighting fixtures.
e. Support outlet boxes for luminaires and other ceiling-mounting devices in lay-in acoustical tile ceilings by bar hangers anchored to ceiling construction members which do not interfere with tile removal.

3. Switch and receptacle boxes for concealed wiring:
   a. Galvanized.
4. Exposed switch and receptacle boxes:
   a. Corrosion resistant, cast, malleable iron, with threaded hubs
   b. Design Basis: Crouse-Hinds Type FS.
5. Weatherproof receptacle boxes:
   a. Corrosion resistant cast malleable iron type, with threaded hubs and neoprene gasket.
   b. Design Basis: Crouse-Hinds Type FS
6. Concealed gang-switch and junction boxes not dimensioned:
   a. Galvanized.
7. Boxes for 277 volt switches on opposite phases:
   a. Where multi-ganging boxes, provide barriers per NEC.
8. Extension Rings:
   a. To suit conditions.
9. Hardware:
   a. Grounding screw and connectors as required by wiring method.

2.2 SUPPORTS

A. Acceptable Manufacturers:
1. Box supporting brackets:
   a. Base:
      1) Caddy MEB1 and SGB Series.
2. Far side box support:
   a. Base:
      1) Hubbell/RACO Catalog No. 978.
3. Other manufacturers desiring approval comply with Section 00 26 00.

2.3 PULL AND JUNCTION BOXES

A. Acceptable Manufacturers:
1. Galvanized boxes and fittings:
   a. Base:
      1) Appleton Electric.
   b. Optional:
      1) Hoffman
      2) Thomas & Betts.
      3) Hubbell Raco.
2. Corrosion resistant boxes and fittings:
   a. Base:
      1) Thomas & Betts (Ocal)
   b. Optional:
      1) Robroy
3. Other manufacturers desiring approval comply with Section 00 26 00.

B. Requirements:
1. Minimum Size:
   a. 4 IN square.
   b. Depth as required.
2. Galvanized steel, code gauge
3. Cover:
   a. Same material as box, screw on type..

2.4 FLUSH FLOOR BOXES

A. Acceptable Manufacturers:
   1. Base:
      a. Hubbell
   2. Optional:
      a. Wiremold
      b. Thomas and Betts
   3. Other manufacturers desiring approval comply with Section 00 26 00.

B. Materials
   1. General:
      a. See Section 26 27 26 and electrical symbol legend for receptacle requirements.
      b. Provide single service or combination power and communication boxes as indicated.
      c. Floor boxes do not provide any fire separation or fire rating.
         1) Floor boxes shall rely upon floor assembly components, physical dimensions, structural materials, etc., to provide fire separation and rating.
   2. Flush in-floor box for duplex receptacle:
      a. Dual level 4 IN round fully adjustable cast iron box.
         1) Floors over 3 IN deep: Hubbell B-2536.
         2) Floors 3 IN deep or less: Hubbell B-2537.
      b. Round aluminum fitting cover, duplex flap: Hubbell SA-3725.
      c. Round aluminum carpet flange: Hubbell SA-3182. Provide as required.
   3. Eleven (11) gang flush in-floor box for power and communications: Wiremold RFB11
      a. Concrete-tight stamped steel construction with 14 gauge sides and bottom and 10 GA steel top.
      b. Nominal box dimensions, plus/minus 2 percent:
         1) Length: 375 mm 14.75 IN.
         2) Width: 320 mm 12.63 IN
         3) Height: 155 mm 6.13 IN.
         4) Wiring volume: 2555 cm 3 156 cubic inches.
      c. Access to each end of floor box shall be provided by concentric 27 mm 1 IN and 35 mm 1.25 IN knockouts.
      d. Access from behind and below each multi-gang compartment shall be provided by concentric 27 mm 1 IN and 35 mm 1.25 IN knockouts.
      e. Access from behind and below each single gang compartment shall be provided by concentric 21 mm .75 IN and 27 mm 1 IN or 27 mm 1 IN and 35 mm 1.25 knockouts.
      f. External pre-pour adjustment shall be provided by at least 50 mm 2 IN leveling screws.
      g. Cover:
         1) Cast aluminum.
         2) Lid to be offered with solid, flush surface for tile, wood or terrazzo and an insert option for carpet inlay.
         3) Egress to be provided by two 24 mm 15/16 IN by 156 mm 6-3/8 IN access doors.
         4) Access door to fold under lid during cable exit for unobtrusive appearance and mechanical protection.
   4. Four (4) compartment flush in-floor box for power and communications: Wiremold RFB4
      a. Cast iron floor box for use on grade and elevated slabs.
      b. Nominal box dimensions (plus/minus 2 percent):
         1) Length: 355 mm 14.5 IN.
         2) Width: 290 mm 11.88 IN
         3) Height: 87 mm 3.44 IN.
         4) Wiring volume: Two compartments at 590 cm 3 36 cubic inches and two at 443 cm 3 27 cubic inches.
      c. Provide four independent wiring compartments that allow capacity for up to four duplex receptacles and/or communication services.
      d. Box shall permit tunneling from adjacent or compartments

e. Provide four 27 mm 1 IN and four 35 mm 1.25 IN conduit hubs.
f. Box shall be fully adjustable, providing maximum of 48 mm 1.88 IN pre-pour adjustment, and a maximum of 19 mm 0.75 IN after-pour adjustment.
g. Cover:
1) Activation covers shall be manufactured of die-cast aluminum or die-cast zinc.
a) Provide brushed aluminum finish.
2) Activation covers shall be available as follows:
a) Flanged (195 mm 7.75 IN long by 165 mm 6.56 IN wide) and flangeless (170 mm 6.75 IN long by 140 mm 5.56 IN wide) versions.
b) With tile or carpet inserts.
c) Flush covers.
d) Covers with one 27 mm 1 IN trade size screw plug opening and one combination 35 mm 1.25 IN and 53 mm 2 IN trade size screw plug openings for furniture feeds.
e) Coordinate cover with floor finish.

2.5 THROUGH-FLOOR SERVICE FITTINGS POKE-THROUGH

A. Acceptable Manufacturers:
1. Base:
a. Hubbell
2. Optional:
a. Wiremold
b. Thomas and Betts

B. Materials
1. Poke-Through Assemblies with Devices:
a. Provide combination power and communication poke-thru devices flush floor mounted.
b. Assembly consists of an insert and an activation cover.
c. Overall poke-thru assembly nominal length shall be 406 mm 16 IN plus or minus 3 percent.
d. Insert body shall have necessary channels to provide complete separation of power and communication services.
e. Provide one 21 mm 3/4 IN trade size channel for power and two 16 mm 1/2 IN trade size channels for communication cabling.
f. Channels shall be arranged such that communication cables can be conduit protected and connected to insert body using die-cast zinc conduit connector with two 16 mm 1/2 IN trade size threaded openings to accept both rigid and flexible conduit connections.
g. Body will consist of an intumescent fire stop material to maintain fire rating of floor slab.
1) Intumescent material will be held securely in place in insert body and shall not have to be adjusted to maintain fire rating of unit and floor slab.
h. Insert shall have spring steel-retaining ring that will hold poke-thru device in floor slab without additional fasteners.
i. Poke-thru insert shall also consist of 21 mm 3/4 IN conduit stub that is connected to insert body and 402 cm3 24.5 cubic inch stamped steel junction box for wire splices and connections.
j. Stamped steel junction box shall also contain necessary means to electrically ground poke-thru device to system ground.
k. Provide trim flange manufactured of die-cast aluminum with brushed finish and lacquer sealant.
l. The overall trim flange shall be nominal 210 mm 8.25 IN diameter plus or minus 2 percent.
m. Provide two 20 amp duplex receptacle prewired with three No. 12 AWG THHN conductors for power applications.
n. Coordinate with data, microphones, and other low voltage Owner requirements.
2. Poke-Through Assemblies for Furniture Connections:

a. Provide poke-thru device to interface between systems furniture and power and communication cabling in ceiling space below.
b. Provide trim flange manufactured of die-cast aluminum with brushed finish and lacquer sealant.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mounting of outlet boxes for concealed wiring.
1. Boxes mounted adjacent to studs shall be attached directly to stud with a minimum of 4 metal screws.
a. Provide far-side box support on all boxes.
b. Box side support shall be secured to box with drywall screws.
2. Boxes that are not attached directly to studs shall be attached to box support bracket spanning studs.
a. Bracket shall be attached to studs with 2 screws at each end.
b. Attach box to bracket with 2 screws minimum.
3. For outlets mounted above or below counters, benches, or furniture, coordinate location and mounting heights with casework, millwork and furniture.
a. Adjust outlet mounting height to agree with required location for equipment served.
4. Position outlet boxes to locate luminaires as shown on reflected ceiling plans.

B. Mounting of junction boxes in existing walls:
1. Where junction boxes or device boxes are to be mounted in existing walls, sufficient drywall shall be removed to allow proper support of box by attaching directly to stud or bracket spanning 2 studs.
a. Patch drywall and seal as required to return wall to original finish.

C. When a metallic junction box for electrical receptacles or switches is contained within a 1 or 2-HR rated fire or smoke wall of gypsum wall board construction and an opening is provided for box in surface of wall, area of opening shall not exceed 16 square inches, unless the junction box is protected by approved UL listed firestop
1. Aggregate area of such junction boxes in a rated wall not protected by an approved firestop shall not exceed 100 square inches in 100 square feet of wall area as measured from floor to structural deck or rated membrane.
2. Junction boxes with openings on opposite faces of rated walls shall have a horizontal separation of 24 inches as a minimum, regardless of box size, unless protected by an approved method.
3. Locations of studs do not have any bearing on the above requirements, nor does the use of mineral wool fire safing alter these requirements.

D. Back to back boxes shall not be installed within the same stud cavity. Where installation within the same stud cavity is required based on device layout, unfaced glass or mineral fiber sound batting shall be installed to prevent sound transfer between rooms.

E. Fill unused punched-out openings in boxes with proper closures.

F. Use outlet boxes sized to accommodate quantity of conductors enclosed.

G. Provide pull boxes or junction boxes in conduit runs where indicated or as required to facilitate pulling of wires or making of connections. Make covers of all boxes accessible.

H. Spray paint inside of boxes and box cover per Section 26 00 10.

I. Identify circuit numbers on inside of box and coverplate.
1. Identification shall be post painting of boxes.

J. Coordinate all floor boxes with available slab depth to assure that concrete depth is adequate for specified box.

1. Set boxes level based on slab depth.
2. Floor box installations shall maintain appropriate fire rating.

K. Poke-through assemblies shall permit all wiring to be completed at floor level.
1. Core drill proper sized hole(s) to accommodate assemblies as required. Coordinate requirements with manufacturer.
2. Locate poke-thru devices a minimum of two (2) foot on center and so that no more than one assembly is provided per 6 m2 65 SF of floor area in each span.
3. Installation shall be completed by pushing unit down into cored hole.
   a. Prior to and during installation, refer to system layout and/or approval drawings.
4. Installer shall comply with detailed manufacturer's instruction sheet included with each device.
5. Each assembly shall contain retainer for securing device in slab, as well as necessary intumescent material to seal cored-hole under fire conditions.

END OF SECTION

SECTION 26 05 46
TELE-POWER POLES

PART 1 - GENERAL

1.1 SUMMARY

A. Provide tele-power pole systems to extend branch circuit wiring and/or data network, voice, video, and other communication cabling to points of use as indicated on drawings.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. System standards:
   1. UL 5 – Standard for Surface Metal Raceways and Fittings.
   2. UL 498 – Standard for Attachment Plugs and Receptacles.
   3. UL-1681 – Standard for Wiring Device Configurations.
   4. NEMA WD 1 – General Color Requirements for Wiring Devices
   5. NEMA WD 6 – Wiring Devices – Dimensional Requirements.

1.3 SUBMITTALS

A. Product Data:
   1. Tele-power poles.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Tele-power poles:
   1. Base:
      a. Wiremold.
      b. Hubbell.

B. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Tele-power poles:
   1. Tele-power pole channel shall be steel with ivory baked enamel finish.
      a. Nominal dimensions (plus or minus 5 mm 0.2 IN):
         1) Cross-section of 76 mm 3 IN by 70 mm 2.8 IN with two separate compartments.
         2) Communications compartment and power compartment to be same size.
         3) Wiremold Series 30TP-4V.
   2. Compartment One:
      a. Factory wired with two 20A, 125V NEMA 5-20R duplex grounding-type specification grade receptacles. Provide receptacle color as indicated in symbol legend.
      b. Receptacle harness shall be single circuit (2 conductor plus ground) with #12 AWG solid type THHN conductors, factory assembled and connected to receptacles.
      c. Provide 152 mm 6 IN conductor leads for termination to overhead wiring system.
      d. Provide 203 mm 8 IN removable cover section at top of power compartment to facilitate hard wiring of pole wire harness.
   3. Compartment Two:
      a. For field installation of telecommunications cabling.

b. Provide removable cover section at bottom of compartment to assemble and mount communications connectors. This section must be removable without dismantling or removing tele-power pole after installation.
c. Cover section shall have four to six knockouts for modular voice-data jacks (RJ-type) and rectangular knockout for modular furniture outlet.
d. Provide “mouse hole” knockout with furnished grommet for straight through communication cable access.

4. Tele-power pole lengths shall be coordinated with furniture provided and each areas ceiling height.
5. Provide fittings for tele-power poles including, but not limited to, entrance end fittings for top of electrical channel for power and communication cabling, ceiling trim plate, pole-mounting bracket, Velcro™ carpet gripper pad and adhesive pad.
6. Tele-power poles must be UL Listed for field modifications, changes and additions of receptacles, devices and circuits. Field installed power device covers shall be available to add duplex, 336 mm 1.40 IN and 40 mm 1.59 IN diameter single and rectangular-type receptacles. Associated plates must be color matched to tele-power pole.
7. Add-on communication covers must be available to mount workstation device faceplates, inserts, and specialty mounting bezels.
8. Tele-power pole manufacturer will provide a complete line of connectivity outlets with multi-media modular inserts for UTP fiber optic, coaxial, and other cabling types.
9. Custom label capabilities shall be available using templates that can be downloaded from Internet.

PART 3 - EXECUTION

3.1 TELE-POWER POLE INSTALLATION

A. Prior to and during installation, refer to system layout or approval drawings containing all elements of system. Installer shall comply with detailed manufacturer’s instruction sheets, which accompany system components, as well as complete system instruction sheets, whichever is applicable.

B. Raceways shall be mechanically continuous and connected to all electrical outlets, boxes, device mounting brackets, and cabinets, also in accordance with manufacturer’s installation sheets.

C. Raceways shall be electrically continuous and bonded in accordance with National Electric Code for proper grounding.

D. Tele-power pole systems shall be installed complete in accordance with manufacturer’s installation sheets. All unused openings shall be closed.

E. Derating of conductors in the power compartment shall be in accordance with product listings. Where quantities exceed these listings conform to NEC deration tables.

F. Coordinate installation of tele-power poles with systems furniture.

END OF SECTION

SECTION 26 09 23
LIGHTING CONTROL DEVICES

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product data:
   1. Technical data on each type of device.
   2. Manufacturer's wiring and installation information.

B. Shop drawings
   1. Occupancy sensor layout
      a. Submit a lighting plan clearly marked by manufacturer showing occupancy sensor type, location and proper orientation.
      b. Submit any applicable interconnection diagrams.

C. Contract closeout information:
   1. Warranty information.
      a. Minimum 5 year warranty for wall-box dimmer switches.
      b. Minimum 5 year warranty for occupancy sensors and associated power packs.

1.2 QUALITY ASSURANCE

A. Provide wiring devices conforming to the following standards:
   1. Underwriter's Laboratories (UL).
      a. UL 20 – Standard for Safety for General-Use Snap Switches.
      b. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
   2. National Electric Manufacturers Association (NEMA).
      a. WD-1 – General Color Requirements for Wiring Devices.
      b. WD-6 – Wiring Devices – Dimensional Requirements.
   3. US Federal Specifications.
      a. Fed Spec switches (WS-896E).
      b. Fed Spec device plates (W-P-455).

PART 2 - PRODUCTS

2.1 MATERIALS - GENERAL

A. Acceptable manufacturers:
   1. Standard toggle switches:
      a. Base:
         1) Hubbell.
      b. Optional:
         1) Cooper.
         2) Leviton.
         3) Pass & Seymour.
      c. All toggle switches shall be of the same manufacturer providing receptacles. Refer to section 26 27 26.
   2. Wall Box Dimmers:
      a. Base:
         1) Lutron.
      b. Optional:
         1) Hunt.
         2) Leviton.

3. Occupancy Sensors:
   a. Base:
      1) WattStopper.
   b. Optional:
      1) Hubbell.
      2) Leviton.
      3) Sensor Switch.
4. Other manufacturers desiring approval comply with Section 01 25 13.

2.2 SWITCHES

A. Lighting switches:
   1. Specification grade, quiet-operating toggle-type with back and side wiring, 120-277 volts, AC only, 20 amp rated unless otherwise indicated.
      a. Switches shall be listed per UL 20 and certified by UL to Federal Specification WS-896E, and shall be visibly marked "Fed Spec WS-896".
      b. All switches shall be equipped with a green grounding terminal.
   2. Use ivory devices for "normal" circuits.
   3. Refer to symbol legend.
   4. Toggle-type switch:
      a. Single-pole: Hubbell HBL1221.
      b. Double-pole: Hubbell HBL1222.
      c. Three-way: Hubbell HBL1223.
      d. Four-way: Hubbell HBL1224.

B. Wall-box lighting dimmers:
   1. Performance.
      a. Dimmers shall provide full-range, continuously variable control of light intensity of incandescent, electronic low voltage, magnetic low voltage, fluorescent and LED loads.
      b. Slider shall be captured behind an approximately 1 IN wide faceplate opening with a vertical linear-slide. Controls shall be thin profile with no exposed heat sink/yoke.
      c. "Slide-to-OFF" controls shall use the vertical slider to turn the control ON and OFF. "Preset" dimmers shall provide the on/off function independent of the dimmer slider position via a push ON / push OFF switch integral to the slider knob and visibly distinct from the slider. For “Preset” dimmers, when the lights are ON, the slider shall change the light level and when the lights are OFF, the slider shall pre-select the light level to which the lights will turn ON.
      d. Control ON / OFF function must be accomplished utilizing a mechanical air-gap switch to totally disconnect power from the load during OFF condition, and no leakage current shall be present at the fixture(s).
      e. Operation at rated capacity shall be possible across the full ambient temperature range (0°C (32°F) to 40°C (104°F)), without shortening design lifetime. This includes modified capacities for ganging configurations which require the removal of fins.
      f. Dimmer shall provide smooth and continuous Square Law dimming curve, for the full slider travel, on their rated load.
      g. Controls shall meet the applicable requirements of UL 20 and UL 1472 referring to the inclusion of a visible, accessible air-gap off switch and the limited short circuit test.
      h. Controls shall meet ANSI/IEEE Std. C62.41-1980, tested to withstand voltage surges of up to 6000V and current surges of up to 200A without damage.
      i. Controls shall incorporate power-failure memory. Should power be interrupted and subsequently returned, the lights will come back on to the same levels set prior to the power interruption.
      j. Dimmer shall include voltage compensation to compensate light output for variation in the AC line-voltage.
      k. 3-way controls shall be connected using conventional 3-way and 4-way wire runs and toggle switches.
   2. LED Driver and Fluorescent Dimming Ballast Dimmers.

a. Dimmer shall have preset slider control.
b. Dimmers shall be designed to provide full ballast output at high-end.
c. Dimmers shall be designed to operate the following ballasts and/or drivers.
1) 0-10VDC control, 10% dimming via a 4-wire ballast or LED driver.
a) Wall-box dimmers shall be Lutron Nova T* slide-to-OFF style, model no. NTFTV (single-pole, 0-10 VDC).
b) Provide external relay to switch ballast power ON / OFF via Lutron power pack model no. PP-20.

3. Wall-box dimmer finishes and face plates.
a. Faceplates shall be manufactured from durable polycarbonate plastic with matte finish, and shall attach to the basic components without using exposed hardware or screws. Faceplates shall match color and finish of dimmer slider controls.
b. Dimmers and faceplates shall be ivory.
c. Control, accessory and faceplate profiles shall not exceed 0.30 inches from wall surface to faceplate front surface.
d. Single-gang faceplate shall be provided with each dimmer.
e. Multi-gang faceplates shall provide a continuous, seamless cover for control and/or accessory combinations with no exposed hardware or screws. Custom faceplate configurations shall be available.
f. For multi-gang applications, derate dimmers per manufacturer's directions, and provide faceplates as follows:
1) Two-gang faceplate shall be Lutron model no. VWP-2.
2) Three-gang faceplate shall be Lutron model no. VWP-3.
3) Four-gang faceplate shall be Lutron model no. VWP-4.

2.3 DEVICE PLATES

A. Device plates for toggle switches and occupancy sensors: Same manufacturer as devices, to suit device covered, single or ganged in one piece with beveled edges that match faces of plates.
1. Flush impact resistant thermoplastic wall plate: Color to match device covered.

B. Labeling:
1. General:
a. Where labeling of device plates is required, provide labeling on inside and out using mechanically created labels.
2. Permanently label device plates for all light switches to indicate panelboard and circuit number supplying them.

C. Device plates for surface type cast-metal boxes: Corrosion resistant cast ferrous metal designed for application.

2.4 OCCUPANCY SENSORS

A. Dual Technology Wall Switch Sensor:
1. Sensor shall be a self contained control system that replaces a standard toggle switch, and shall detect presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes, and shall utilize dual sensing verification for coordination between both technologies to reduce likelihood of false operations.
2. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
3. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
4. Sensor shall have its factory preset in a default mode in which both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting ON, and detection by either technology shall turn lights back ON after lights were turned OFF for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
5. Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.

6. Sensor shall cover up to 1,000 sq. ft. for walking motion, with a field view of 180 degrees.
7. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt incandescent; 0 to 800 Watt fluorescent or 1/6 hp @ 120 VAC, 50/60Hz; and 0 to 1200 Watt fluorescent @ 230/277 VAC, 50/60Hz.
8. Sensor shall be able to control incandescent, magnetic low voltage, electronic low voltage, and fluorescent loads.
9. Sensor shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
10. Sensor shall have automatic-ON or manual-ON operation adjustable with DIP switch.
11. Sensor shall have a time delay adjustable from 5 to 30 minutes, set by DIP switches.
12. In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
13. Sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
14. Sensor shall not protrude more than 3/8” from the wall.
15. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Automatic ON mode.
16. Wattstopper model no. DW-100 and DW-103 for multi-way switching applications.

B. Dual Technology 360º Ceiling Sensor:
1. Sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.
2. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for changing levels of activity and airflow throughout controlled space.
3. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
4. Sensor shall coordinate between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting ON.
5. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system ON within 5 seconds of being switched OFF.
6. Sensors shall be ceiling mounted with a flat, unobtrusive appearance and provide 360° coverage.
7. Sensor shall operate at 24 VDC/VAC and utilize a power pack.
8. The lens shall cover up to 1000 SQ FT of walking motion.
9. Sensors shall have a time delay that is adjustable from 5 to 30 minutes, set by DIP switch.
10. Sensors shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
11. Sensors shall have a built-in light level sensor that works from 10 to 300 footcandles.
12. Sensor shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
13. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
14. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Automatic ON mode.
15. WattStopper model no. DT-300.

C. Dual Technology Directional Ceiling/Wall Sensor:
1. Sensor shall be capable of detecting presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes.
2. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout controlled space.

3. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.
4. Sensor shall coordinate between ultrasonic and PIR technologies. Detection verification of both technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting ON.
5. Sensor shall have a retrigger feature in which detection by either technology shall retrigger the lighting system ON within 5 seconds of being switched OFF.
6. Sensor shall be capable of corner mounting to a wall or a ceiling in order to eliminate detection through open doorways and outside of controlled area.
7. Sensor shall operate at 24 VDC/VAC and utilize a power pack.
8. The lens shall cover up to 2000 SQ FT for walking motion when mounted at 10 FT and 1000 SQ FT of desktop motion.
9. Sensors shall have an additional single-pole, double throw isolated relay with normally open, normally closed and common outputs. The isolated relay is for use with HVAC control, data logging, and other control options.
10. Sensors shall have a time delay that is adjustable from 5 to 30 minutes, set by DIP switch.
11. Sensors shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds.
12. Sensor shall have an override ON function for use in the event of a failure.
13. Sensor shall have a built-in light level sensor that works from 10 to 300 footcandles.
14. Each sensing technology shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled. The LED can be disabled.
15. Time delay shall be set at 5 minutes and high PIR sensitivity with relay in Automatic ON mode.
16. WattStopper model no. DT-200.

D. Power Pack:
1. Power pack shall be a self contained transformer and relay module measuring 1.75 IN x 2.75 IN x 1.75 IN. Power pack shall have primary dual-voltage inputs of 120/277 VAC.
2. Power pack shall have dry contacts capable of switching 20 amp ballast and incandescent load @ 120 VAC, 60 Hz, 1 hp @ 120-250 VAC, 60 Hz; 20 amp ballast @ 277 VAC, 60 Hz.
3. Power pack shall provide a 24 VDC, 225 mA output.
4. Power packs shall be capable of parallel wiring without regard to AC phases on primary.
5. Power pack can be used as a stand alone, low voltage switch, or can be wired to sensor for auto control.
6. Power pack shall have hold-ON and hold-OFF inputs for integration with lighting control panels, BMS and other building systems.
7. Power pack shall have overcurrent protection if the low voltage current drawn exceeds 225 mA. In the event of an overcurrent, the low voltage output current shuts down and the LED will blink to indicate a fault condition.
8. Power pack shall be UL 2043 plenum rated and shall have low voltage teflon coated leads, rated for 300 volts.
9. WattStopper model no. BZ-150.

E. Dual Technology, Dual Relay Wall Switch Sensor:
1. Sensor shall be a self contained control system that replaces two standard toggle switches. Sensor shall detect presence in the control area by detecting Doppler shifts in transmitted ultrasound and passive infrared heat changes, and shall utilize dual sensing verification for coordination between both to reduce likelihood of false operations.
2. Ultrasonic sensing shall be volumetric in coverage with a frequency of 40 KHz. It shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and air flow throughout the controlled space.
3. The PIR technology shall utilize a temperature compensated, dual element sensor and a multi-element Fresnel lens.

4. Sensor shall have its factory preset in a default mode in which both technologies must occur in order to initially activate lighting systems. Detection by either technology shall maintain lighting ON, and detection by either technology shall turn lights back ON after lights were turned OFF for 5 seconds or less in automatic mode and 30 seconds or less in manual mode.
5. Selection of technologies for initial, maintain, and re-trigger shall be done with DIP switches.
6. Sensor shall cover up to 1,000 sq. ft. for walking motion, with a field view of 180 degrees.
7. Sensor shall have no minimum load requirement and shall be capable of switching from 0 to 800 Watt incandescent; 0 to 800 Watt fluorescent or 1/6 hp @ 120 VAC, 50/60Hz; and 0 to 1200 Watt fluorescent @ 230/277 VAC, 50/60Hz.
8. Sensor shall be able to control incandescent, magnetic low voltage, electronic low voltage, and fluorescent loads.
9. Sensor shall feature a walk-through mode, where lights turn OFF 3 minutes after the area is initially occupied if no motion is detected after the first 30 seconds, set by a DIP switch.
10. Sensor shall have automatic-ON or manual-ON operation adjustable with DIP switch.
11. Sensor shall have a time delay adjustable from 5 to 30 minutes, set by DIP switches.
12. In automatic mode, sensor shall be capable to automatically return to Automatic-ON after lights are turned off manually.
13. Sensor shall have an LED indicator that remains active at all times in order to verify detection within the area to be controlled.
14. Sensor shall not protrude more than 3/8” from the wall.
15. Time delay shall be set at 5 minutes and high PIR sensitivity with Relay 1 in Automatic ON mode and Relay 2 in Manual ON mode
16. WattStopper model no. DW-200.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate devices as indicated and as scheduled in Section 26 00 10.

B. Center devices with regard to paneling, furring, trim, etc.

C. Any device which is improperly located must be corrected at Contractor's expense.

D. Set devices plumb or horizontal and extending to finished surface of wall, ceiling or floor as case may be without projecting beyond same.

E. A neutral conductor and grounding wire shall be routed to every junction box containing a line voltage switch.

F. Dimmer switches:
   1. Derate dimmer switches to 80 percent of rated capacity. Derate dimming switches that are ganged, as recommended by manufacturer.

G. Occupancy Sensors:
   1. The locations and quantity of sensors shown on the drawings are diagrammatic and indicate only the rooms and spaces to be provided with sensors.
   2. Verify sensor type, quantity, location, aiming and sensitivity with manufacturer's recommendations. Set time delays and light level sensitivities of devices, if applicable, per the specifications.
   3. All controlled spaces shall be tested to insure 90 to 100 percent coverage of the controlled space. If test fails, adjust sensitivity, re-aim, relocate, and/or add sensor(s) as required at no cost to Owner.
   4. The Contractor shall provide the Owner with the training necessary to familiarize the Owner’s personnel with the operation and proper adjustment of the occupancy sensing devices and systems.
   5. Power supplies and slave units if required shall be located above accessible ceilings.

3.2 CLEANING

A. The contractor shall remove all paint spatters and other spots, dirt and debris from the equipment. Clean equipment and devices internally and externally using methods and materials recommended by the manufacturer.

END OF SECTION

SECTION 26 09 43
NETWORK LIGHTING CONTROLS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:
   1. Network integrated power switching and dimming systems.
   2. Modular, network integrated, room lighting switching and dimming controllers.

B. Related Information:
   1. Division 26 Section "Electrical General Requirements".
   2. Division 26 Section "Lighting Control Devices" for switches, occupancy sensors, photoelectric sensors.
   3. Division 26 Section "Building Lighting" for luminaires controlled by network lighting control systems.

1.2 REFERENCES

A. National Fire Protection Association (NFPA):
   1. NFPA 70 - National Electrical Code.

B. Underwriters Laboratories (UL)
   1. UL 508 – Industrial Control Equipment

1.3 ABBREVIATIONS

A. BMS: Building Management System.

B. AV: Audio Visual.

1.4 SYSTEM DESCRIPTION

A. Web-accessible, network connected, lighting control system utilizing preset control software, central signal microprocessor, lighting control panels including , solid-state power switching modules and relays and dimming modules.

B. Microprocessor-based, modular solid-state dimming and switching devices utilizing preset control software, in an integrated control system including the following:
   1. Lighting Controller System: Concealed mounting, self contained, multichannel controller with user-adjustable dimmer and equipment controls with network and expansion capabilities:
      a. Integrated lighting, dimming, and switching controls.

C. Web-accessible, network-connected, Windows-based energy and lighting management software to provide lighting, occupancy sensing, and occupied/unoccupied lighting schedules.

D. System Components: System includes the following addressable components:
   1. Keypad controls.
   2. Remote occupancy sensors.
   3. Timed room lighting.

1.5 ACTION SUBMITTALS

A. Product Data: For each type of product required for complete network lighting control system, demonstrating compliance with requirements.

B. Software Product Data: Provide full description of network lighting management software including available screens, commands, room schedules, room-by-room access tree, monitoring capabilities, and controls.
   1. Describe total capacity of software to manage multiple rooms, building zones, campus- and enterprise-wide lighting, and to coexist with multiple PCs, touchpanels, and keypads with simultaneous access.
   2. Describe security features that limit access to the system and limit authorized users to assigned duties.
   3. Describe services available on software. Describe supervisors' capabilities to create new user accounts, back up program, and establish separate program and user accounts to be used under differing circumstances.
   4. Provide documentation that software complies with the full intent of this Section.

C. Shop Drawings: Indicated the following:
   1. Schematic diagram showing complete network lighting control system and accessories.
   2. Circuits and emergency circuits with capacity and phase, control zones, load type and voltage per circuit.
   3. Flow chart of software instructions and sequence of operations.
   4. Schematic diagram showing complete networked system of hardware connections.

1.6 INFORMATIONAL SUBMITTALS

A. Sample of manufacturer's warranty.

B. Load Measurement Report: Submit field test report of completed installation.

1.7 CLOSEOUT SUBMITTALS

A. Operating and maintenance instructions.

B. Record drawings of network system. Show physical routing of cables and location of touch panels, keypads, window shade controllers, lighting control panels.

C. Provide copy of warranty and software licenses for the specified term.

1.8 QUALITY ASSURANCE

A. Source Requirements: Provide Network Lighting Controls and network lighting management software and license through a single source from a single manufacturer.

B. Manufacturer Qualifications: Approved manufacturer of network lighting controls and lighting management software listed in this Section with minimum five years record of satisfactory manufacturing and support of components comparable to basis of design system.
   1. Approval of Comparable Products: Submit the following in accordance with project substitution requirements, within time allowed for substitution review:
      a. Product data, including certified independent test data indicating compliance with requirements.
      b. Samples of each component.
      c. Written description of the functions and controls provided by software.
      d. Sample submittal from similar project.
      e. Project references: Minimum of 5 installations not less than 5 years old, with Owner and Architect contact information.
      f. Sample warranty.
   2. Approved manufacturers must comply with separate requirements of Submittals Article.

C. Electrical Components, Devices, and Accessories: UL listed and labeled per NFPA 70.

1.9 COORDINATION

A. Coordinate integrated lighting and dimming controls with systems and components specified in the following sections:
   1. Division 26 Section "Lighting Control Devices".
   2. Division 26 Section "Building Lighting".

1.10 PROJECT CONDITIONS

A. Environmental Conditions Range:
   1. Temperature: 32 – 104 deg F (0 - 40 deg C).
   2. Relative Humidity: 10 – 90 percent, noncondensing.

1.11 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of lighting controls system and lighting management system that fail in materials or workmanship within the specified warranty period following substantial completion.
   1. Warranty Period: Touch screen display and overlay components: 90 days.
   2. Warranty Period: Disc drives and other moving parts, pan/tilt heads, and power supplies: 1 year.
   3. Warranty Period: Other components, 3 years. 8 years.

B. Manufacturer's Extended Support and Maintenance Program: Provide proposal to Owner for manufacturer's annually-renewable extended support and maintenance program to consist of the following:
   1. Parts and labor required for system maintenance.
   2. Technical hotline support.
   3. Remote diagnostics and programming support.

1.12 SOFTWARE SUPPORT AGREEMENT

A. Software Agreement: Manufacturer to provide software and firmware updates and onsite software and firmware support for a period of 5 years from the date of substantial completion at no charge to the Owner.

B. Provide proposed extended service agreement including fees for support beyond the five years.

PART 2 - PRODUCTS

2.1 NETWORK LIGHTING CONTROL SYSTEM

A. Acceptable Manufacturers:
   1. Network lighting control system:
      a. Base:
         1) Crestron
      b. Optional:
         1) Cooper Controls
         2) Lutron
         3) Wattstopper
   2. Other manufacturers desiring approval, comply with Section 00 26 00.

2.2 SYSTEM CHARACTERISTICS

A. Web-accessible, network-connected programmable lighting control system that receives digital or analog signals from addressable input devices, assembles signals at central signal processor, and distributes operating signals to addressable control devices that affect a change in state.

1. Electronic power switching modules and relays process signals and affect circuit on-off switching, emergency switching, and 0 – 10V fluorescent and LED dimming where indicated. Electronic dimming modules incorporating mechanically latching relays for dimming and on-off switching. Emergency switching overrides preset state and puts each circuit to the programmed emergency condition. Buttons on the module provide manual disconnect and manual circuit testing.

2.3 NETWORK LIGHTING CONTROL PANELS

A. Control Panels, General: Comply with NEMA PB 1 and UL 50 (CAN/CSA C22.2, No. 94), UL 67 (CSA C22.2, No. 29), UL 489 (CAN/CSA C22.2, No. 65), and UL 916 (CSA C22.2, No. 205).

B. Feed-Through Network Lighting Control Panels: Standard high inrush.
   1. Basis of Design Product: Crestron Green Light Express Power Switching Network Lighting Control panel Model GLPS-SW-FT.
   2. Branch Circuit Protection: Pass through type utilizing separate branch circuit protection indicated on Drawings.
   3. Hinged Door.
   4. Switching Relay Types: Standard high inrush, lifetime rated minimum 100,000 on/off cycles, with air gap off protection.
   5. Cabinet Capacity: As required for circuits indicated.

C. Feed-Through Network Lighting Control Panel: Feed-through Type, No Branch Circuit Protection.
   1. Basis of Design Product: Crestron Green Light Express Architectural Dimming Control Panel Model No. GLPD-DIM-FT.
   2. Branch Circuit Protection: Pass through type utilizing separate branch circuit protection indicated on Drawings.
   3. Electronic Dimming types: [Incandescent, Magnetic Low-Voltage, Electronic Low-Voltage, Neon/Cold Cathode, Fluorescent Lamp Ballast, High-Intensity Discharge, or Motors] [0-10 Volt 4-Wire Dimmable Fluorescent Ballast].
   4. Switching Relay Types: Arc-less high inrush, lifetime rated minimum 1,000,000 on/off cycles, with air gap off protection.
   5. Emergency Override: Remote override capability.

2.4 DIMMING AND SWITCHING MODULES

A. Switching Module, High Inrush:
   1. Basis of Design Product: Crestron Electronic Power Switching Module Model No. GLXP-SW- series.
   2. Channels of Switching: 10, 12 or 16 channel high inrush switching. Refer to Lighting Control Panel Schedules for arrangements required.
   3. Maximum Load.
      a. Lighting: 16A per channel.
      b. Motor: 1HP at 120V or 2HP at 230/277V per channel.

B. Dimming and Switching Module: 0–10V fluorescent ballast dimming module.
   1. Basis of Design Product: Crestron Electronic Power Switching Module Model GLXP-DIMFLV8.
   2. Module Description: Field replaceable 0-10V fluorescent ballast dimming modules include 8 channels of 4-wire, fluorescent dimming with high inrush, zero-cross arcless, mechanical latching, air gap off relays rated for 1,000,000 on/off lifetime cycles of switching. Module features individual circuit load indicator, mechanical and emergency override and manual line test features. Emergency signal from phase loss sensor overrides the preset state of the dimming control; and changes it to the preprogrammed emergency condition. Phase-synchronous Detection Circuitry eliminates lamp flicker.
   3. Channels of Switching: 8 channel of dimming with switching relays.
   4. Maximum Dimmable Load.

a. 0-10V Fluorescent Lighting: 16A per channel.
b. Motor: [0.5HP at 120V] [1HP at 230/277V] per channel.

C. Switching Module, High Inrush:
1. Basis of Design Product: Crestron Electronic Power Switching Module Model No. GLX-HSW8.
2. Channels of Switching: 8 channels of arc-less high inrush switching.
3. Relay Lifetime: Rated minimum of 1,000,000 on/off cycles, with air gap off protection.
4. Maximum Load.
a. Lighting: 16A per channel.
b. Motor: 0.5HP at 120V or 1HP at 230/277V per channel.

D. Dimming and Switching Module: 0–10V fluorescent ballast dimming module.
1. Basis of Design Product: Crestron Electronic Power Switching Module Model GLX-DIMFLV8.
2. Module Description: Field replaceable 0-10V fluorescent ballast dimming modules include 8 channels of 4-wire, fluorescent dimming with high inrush, zero-cross arcless, mechanical latching, air gap off relays rated for 1,000,000 on/off lifetime cycles of switching. Module features individual circuit load indicator, mechanical and emergency override and manual line test features. Emergency signal from phase loss sensor overrides the preset state of the dimming control; and changes it to the preprogrammed emergency condition. Phase-synchronous Detection Circuitry eliminates lamp flicker.
3. Channels of Switching: 8 channel of dimming with switching relays.
4. Maximum Dimmable Load.
a. 0-10V Fluorescent Lighting: 16A per channel.
b. Motor: [0.5HP at 120V] [1HP at 230/277V] per channel.

2.5 AUTOMATED CONTROL PROCESSOR

A. Control Processor: Central control processor for automation and control systems. Control processor is capable of integrated system control including native intersystem communication with equipment and processors by same manufacturer as well as scheduling and management servers. Control processor shall be the central connecting point for equipment and devices under control in a specified system. As the central element of communication for system devices under control, and all devices and sensors providing status, and feedback, the control processor integrates multiple disparate devices and systems without requiring multiple third party protocol adaptors, translators, or gateways. The control processor is also capable of sharing status, state, and feedback information from other connected devices.
1. Basis of Design Product: Crestron 3-Series Control System MC3
2. Mounting: Modular enclosure-mounted in array indicated.
3. Minimum Characteristics:
a. Operating System:
1) Modular architecture supports multiple simultaneous running programs.
a) Number of simultaneously running user programs: 10
2) Real-time, preemptive multithreaded/multitasking kernel.
3) Vector floating point coprocessor.
4) Utilize a real time, event driven, multi-tasking, multi-threaded operating system.
b. Communication:
1) Control Processor shall support direct communication with the following devices:
a) Connected Ethernet devices.
b) Devices connected to built-in control ports.
c) Proprietary control network devices.
d) BACnet IP devices.
e) Control processors of same type.
c. Native BACnet/IP
1) Maximum number of BACnet objects supported: 500
d. Registered Emerge Alliance wireless system controller.

e. Wireless Communication
   1) Built-in RF transceiver
      a) Communication with up to 100 wireless devices.
f. Video Graphics Engine
   1) Built-in graphics engine:
      a) Support for custom control graphics for onscreen control using a separate remote.
g. Audio
   1) Playback of the following file types:
      a) WAV
      b) MP3
      c) WMA
   2) Stereo pass through switching using built-in analog stereo audio input and output. The following parameters shall be supported:
      a) Switch between digital file playback and input connectors.
   3) Analog to Digital Conversion:
      a) 24-bit 48,000 Hz.
   4) Digital to Analog Conversion:
      a) 24-bit 48,000 Hz.
   5) Frequency Response:
      a) 20Hz – 20,000Hz plus or minus 2dB
   6) Signal to Noise Ratio:
      a) Greater than 93dB, 20Hz to 20,000Hz A-Weighted
   7) Total Harmonic Distortion plus Noise:
      a) Less than 0.01 percent, 20Hz to 20,000Hz
   8) Stereo separation:
      a) Greater than 91dB
h. File Structure:
   1) Transaction-safe extended FAT32 file system.
i. Memory:
   1) RAM:
      a) 256 GB
   2) Flash:
      a) Built-In: 2 GB
   3) External Storage
      a) Supports up to 1 TB.
j. Network:
   1) Built-in 10/100BaseT Ethernet port.
   2) Built-In Web Server: IIS v.6.0
   3) SNMP remote management.
   4) Active Directory support.
   5) IPv6 ready.
   6) TCP/IP Communications
   7) DHCP and DNS Support
   8) Native Email Client
   9) Remote Diagnostics
   10) Remote Program Loading and Administration
   11) SSL security plug in
   12) Support user assigned or dynamic IP address.

2.6 SYSTEM ACCESSORIES

A. Remote Keypad Controls: Field-configurable remote keypad with auto-adjusting backlight illuminating replaceable, engravable programmable buttons in number indicated, with white LED indicators, configured to fit in standard single-gang box.
   1. Basis of Design: Crestron, Cameo Series Keypad Model C2N-CB (D/F) Series.

2. Color: As selected from manufacturer's full range of minimum 12 colors.
3. Faceplates: Per Owner’s direction.

B. Dual Technology Occupancy Sensor: Combination of ultrasonic motion detection and passive infrared detection with internal microprocessor. Sensor independently adjustable for installed conditions. Delayed time off adjustment. Each side of sensor can be programmed separately along with independent sensitivity adjustment of each sensor. Walk-through mode. Grace occupancy feature. Adjustable built-in photocell for daylight optimization. Equipped with connector to tie directly into control system for both power and control.
   1. Basis of Design: Crestron GLS-ODT-C-CN
   2. Mounting and Coverage: As Indicated.

C. Occupancy Sensor Interface Device: Integrates occupancy sensors and related sensors with control network. In separate enclosure. 4-wire bus providing 24 VDC power to network devices, with two independent sensing inputs.
   1. Basis of Design: Crestron Sensor Integration Module Model GLS-SIM.

D. Power Supply: 50W, 24 V regulated power supply with two 4-pin network connectors, fuse-protected.
   1. Basis of Design: Crestron Cresnet Power Supply Model GLA-PWS-50.

2.7 CONDUCTORS AND CABLING

A. Power Supply Side of Remote-Control Power Sources: Comply with requirements of Division 26 Section "Low-Voltage Electrical Power Conductors."

B. UTP Cable: 100-ohm, UTP. Listed and labeled by an NRTL acceptable to authorities having jurisdiction as complying with UL 444 and NFPA 70 for the following types:
   1. Communications Control Cable, Non-Plenum Rated: 22 AWG data pair stranded bare copper, and 18 AWG power pair stranded bare copper, Type CM.
      a. Basis of Design Product: Crestron CRESNET-NP.
   2. Communications Control Cable, Plenum Rated: 22 AWG data pair, stranded bare copper and 18 AWG power pair, stranded bare copper, Type CMP, complying with NFPA 262.
      a. Basis of Design Product: Crestron CRESNET-P.
   3. Communications High-Power Control Cable, Non-Plenum Rated: 22 AWG stranded bare copper data pair, and 12 AWG stranded bare copper power pair, Type CM.
      a. Basis of Design Product: Crestron CRESNET-HP-NP.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Prior to installation:
   1. Examine work area to verify measurements, and that commencing installation complies with manufacturer's requirements.
   2. Examine host computer to confirm that it meets requirements for installation of manufacturer's software.

3.2 PRE-INSTALLATION MEETING

A. Manufacturer and installer of Network Lighting Management Software to coordinate a meeting of the mechanical and electrical engineer, mechanical and electrical contractor, lighting, window shade and HVAC equipment manufacturers. Include any designers and contractors for any other direct digital control system designed to interact with product of this Section.
   1. Discuss interconnection and interoperability of other equipment with lighting management software.

3.3 INSTALLATION

A. Comply with requirements of Division 26 Section "Electrical General Requirements."

B. Do not install network power controls until space is enclosed, HVAC systems are running, and overhead and wet work in space are complete.

C. Install all lighting control cabling in conduit or cable tray. Cabling to and from cable tray for any devices, equipment, and the like shall be ran in conduit.

D. Size conductors in accordance with network lighting control manufacturer's instructions. Install network lighting controls in accordance with manufacturer's instructions.

E. Grounding: Provide electrical grounding in accordance with NFPA 70.

F. Provide panelboard schedule in pocket provided in panel doors.

G. Perform setup for each lighting scene.

3.4 SOFTWARE INSTALLATION

A. Install and program software in accordance with this Section to meet the Owner's requirements. Provide current licenses and backup copies of the software for the Owner's records.

3.5 SYSTEM STARTUP

A. Provide system startup and adjustment to occupied conditions in accordance with manufacturer's recommendations.

B. Switch each load on and off with manual line test feature of the control modules before installing processors.

C. Perform operational testing to verify compliance with Plans and Specifications. Adjust as required.

D. Measure and record load on each controlled circuit in each scene. Submit report of load measurements.

3.6 ADJUSTING

A. Within 12 months of the date of Substantial Completion provide onsite service to adjust the system to account for actual occupied conditions.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Schedule demonstration with Owner, to allow verification that controls function as required.

B. Training: Train Owner's personnel to operate, maintain, and program network systems and network lighting management software. Allow for a minimum of two trips to the jobsite to provide additional training as needed.
   1. Furnish set of approved submittals, and record drawings of actual installation for Owner's personnel in attendance at training session.

END OF SECTION

SECTION 26 22 13
LOW VOLTAGE DISTRIBUTION TRANSFORMERS

PART 1 - GENERAL

1.1 SUBMITTALS

A. Product data:
   1. Technical data on each type of transformer.
   2. No load core loss and full load coil loss data.
   3. Percent impedance and X/R ratio data.

B. Contract closeout information:
   1. Operating and maintenance data.

1.2 QUALITY ASSURANCE

A. Provide transformers conforming to following standards:
   1. NEMA-ST20.
   2. UL-1561.
   3. NEMA-TP1.
   4. NEMA-TP2.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Acceptable manufacturers:
   1. Dry-type transformers:
      a. Base:
         1) Schneider Electric/Square D.
         2) Eaton Electrical.
         3) General Electric.
         4) Siemens.
   2. Other manufacturers desiring approval comply with Section 00 26 00.

B. Ratings information:
   1. All insulating materials are to exceed NEMA ST20 standards and be rated for 220°C UL component recognized insulation system.
   2. Three phase transformers 15kVA and larger shall be 150 degC temperature rise above 40 degC ambient.
   3. Three phase transformers 15kVA and larger shall have a minimum of 4 - 2.5 percent FCBN primary taps and 2 – 2.5 percent FCAN primary taps.
   4. Three phase transformers smaller than 15 kVA shall have a minimum of 2 – 5 percent FCBN primary taps.
   5. Maximum temperature of top of enclosure shall not exceed 50 degC rise above a 40 degC ambient.
   6. Transformers shall be low loss type with minimum efficiences per NEMA TP1 when operated at 35% of full load capacity. Efficiency shall be tested in accord with NEMA TP2.

Single Phase		Three Phase	
kVA	Efficiency	kVA	Efficiency
15	97.7%	15	97.0%

25	98.0%	30	97.5%
37.5	98.2%	45	97.7%
50	98.3%	75	98.0%
75	98.5%	112.5	98.2%
100	98.6%	150	98.3%
167	98.7%	225	98.5%

C. Construction:
   1. Transformer coils (except buck/boost type) shall be dual winding of continuous wound construction and shall be impregnated with nonhygroscopic, thermosetting varnish.
   2. All cores to be constructed with low hysteresis and eddy current losses. Magnetic flux densities are to be kept well below saturation point to prevent core overheating.
   3. Completed core and coil shall be bolted to base of enclosure but isolated by means of rubber vibration-absorbing mounts.
   4. Provide copper windings.
   5. There shall be no metal-to-metal contact between core and coil and enclosure except for a flexible safety ground strap.
   6. Sound isolation systems requiring complete removal of all fastening devices will not be acceptable.
   7. Core of transformer shall be visibly grounded to enclosure by means of a flexible grounding conductor sized in accordance with applicable UL and NEC standards.
   8. Transformer enclosures shall be ventilated (30 kva and above) and fabricated of heavy gauge, sheet steel construction.
   9. Provide finish suitable for outdoor applications as applicable.
   10. Provide weather shields for outdoor units.

D. Sound levels shall be warranted by manufacturer not to exceed following:
   1. 15 to 50KVA: 45dB
   2. 51 to 150kVA: 50dB
   3. 151 to 300kVA: 55dB.
   4. 301 to 500kVA: 60dB.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

B. Provide minimum of 6 IN clearance on both sides and rear of all ventilated transformers or greater when required by manufacturer.

C. External wiring connections: Use flexible steel conduit. See Section 26 05 33.

D. Provide wall mounting brackets and/or trapeze mounting supports and bracing as indicated or as required.

E. Floor-mounted transformers shall be mounted on concrete pads per Section 26 00 10.

F. Provide labeling per Section 26 00 10.

END OF SECTION

SECTION 26 24 16
PANELBOARDS

PART 1 - GENERAL

1.1 SUMMARY

A. Provide distribution panelboard(s) and lighting and appliance panelboard(s) as specified herein and as indicated on associated schedules and drawings.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. System standards:
   1. NEMA PB-1 – Panelboards.
   2. NEMA PB-1.1 – Instructions for Safe Installation, Operation and Maintenance of Panelboards rated 600 volt or Less.
   3. NEMA KS 1 – Enclosed and Miscellaneous Distribution Equipment Switches (600 Volts Maximum)
   4. UL 50 – Enclosures for Electrical Equipment.
   5. UL 67 – Panelboards.
   6. CSA Standard C22.2 No. 29-M1989 – Panelboards and Enclosed Panelboards.
   7. Federal Specification W-P-115C – Type I Class 1.
   8. Federal Specification W-P-115C – Type II Class 1.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Identify panelboards by alphanumeric designation with branch circuit breaker sizes and types indicated in panelboard schedules or one-line-diagram.

B. Product Data:
   1. Technical data on each type of panelboard.

C. Contract Closeout Information:
   1. Operating and maintenance data.

1.4 DEFINITIONS

A. Lighting and and appliance branch circuit: Branch circuit that has a connection to the neutral of the panelboard and that has overcurrent protection of 30 amperes or less in one or more conductors.

B. Lighting and appliance branch-circuit panel boards: Panelboard having more than 10 percent of its overcurrent devices protecting lighting and appliance branch circuits.

C. Power Panelboard: Panelboard having 10 percent or fewer of its overcurrent devices protecting lighting and appliance branch circuits. The terms “power panelboard” and “distribution panelboard” will be used interchangeably.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Panelboards:
   1. Base:
      a. Eaton Electrical.

b. Schneider Electric/Square D.
c. Siemens.
d. General Electric.

B. Other manufacturers desiring approval comply with Section 00 26 00.
1. Eaton Electrical types listed for quality and performance reference.

2.2 MATERIALS

A. All panelboards: Dead front type.
1. Provide with non-insulated equipment grounding terminal strip located in top or bottom gutter including main grounding lug and individual terminals for at least 50 percent of panel circuits including spare circuits and space provisions; increase gutter space accordingly for grounding strip.
2. Provide lighting panelboards with branch circuit connection to main bus arranged for sequence phasing.
3. Provide feed-thru lugs or sub-feed lugs for 2 and 3 section panels.
4. Equip bus bars for panelboard with main lugs, main fused switch or main circuit breaker, capacity as required or indicated.
5. Panelboard bussing to be copper.
6. Provide special features such as split bus, lighting contactors, extra-width gutters as required.
7. Provide panelboard buses fully rated for specified interrupting rating. Series rating of panelboards and overcurrent protective devices is not acceptable.
8. Provide full length busing including areas indicated as space only.

B. Circuit breaker panelboards:
1. Provide bolted-on circuit breaker type. Plug-in circuit breakers not acceptable.
2. Do not install feeder or branch circuit breakers in sub-feed section of panel.
3. Main circuit breaker shall not be located in branch circuit section of panel unless specifically indicated.
4. In power and distribution panelboards, provide main buses and back panels which permit changing of circuit breakers without additional machining, drilling or tapping.
5. All multi-pole breakers provide single handle with common trip.
6. All multi-pole breakers, 100A rated and larger shall include means for padlocking in “OFF” position.
7. Include provisions for locking specific circuit breakers in the “ON” position where indicated.
8. Provide shunt trip mechanism on breakers where indicated.
9. Provide ground fault protection as indicated coordinated with upstream devices.
10. Design so a combination of one, two and three pole circuit breaker can readily be assembled in the same panelboard.
11. Circuit breakers operable in horizontal or vertical position and removable from front of panelboard without disturbing adjacent units.
12. Tandem or half-size circuit breakers not allowed.
13. Panelboard ratings:
    a. In 120/208 V panelboards: Minimum 10,000 AIC symmetrical, or greater as indicated.
    b. In 277/480 V panelboards: Minimum 14,000 AIC symmetrical, or greater as indicated.
14. Lighting and appliance branch-circuit panelboards:
    a. Types PRL1a, PRL2a and PRL3a.
15. Distribution panel boards (circuit breaker type):
    a. Type PRL4B.

C. Circuit breakers: Thermal-magnetic type unit construction, employing quick-make and quick-break toggle mechanisms for manual operation as well as automatic operation.

D. Handles with three positions: "OFF", "ON", and "TRIPPED".
1. When circuit breaker opens on overload or short circuit, operating handle shall automatically assume "TRIPPED" position and clearly indicate abnormal condition of circuit.

E. Cabinets: Trim, door and box, of galvanized sheet steel, code thickness.

1. 5-3/4 IN deep by 508 mm 20 IN wide minimum.
2. Fasten trim to cabinet by means of adjustable clamps.
3. Equip door with chrome-plated combination lock and catch; supply two milled keys with each lock; key locks alike.
4. Provide directory frame on inside of door.
5. Identify all circuit locations in each respective panel with load and location served.
   a. Directory shall be typed.
   b. Mechanical equipment identified in directory shall be same as designation indicated on plans.
   c. Where circuits in existing panels are modified or added a new updated typed directory shall be provided for the existing panel. Update description for all new, modified and spare circuits and spaces only. All descriptions for existing circuits not affected by Contractor's work will be responsibility of Owner unless otherwise indicated. Submit final draft to Owner for comments or changes prior to typing final directory.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

B. Panelboard cabinet supports:
   1. Finished areas: Attach to studs via unistrut cross members or metal backing bolted or welded to studs where not otherwise shown.
   2. Masonry or concrete walls: Attach to wall via unistrut cross members where not otherwise shown.

C. Wall mounted panelboards shall be installed 6 IN above floor minimum. Large panels that rest on floor shall be mounted on house-keeping pads per Section 26 00 10.

D. Provide spare conduits into accessible ceiling space from all flush wall mounted panel boards. Provide one spare 3/4 IN conduit for each 3 spare and/or space branch circuit poles or fraction thereof but no less than two spare 3/4 IN conduits.

3.2 LABELING

A. Provide panelboard labeling as specified in Section 26 00 10.

B. Permanently post, at each panelboard, the conductor color coding scheme specified in Section 26 05 19.

END OF SECTION

SECTION 26 24 19
MOTOR CONTROL EQUIPMENT

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Motor Control Equipment, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 SUBMITTALS

A. Shop Drawings:
   1. Motor control equipment:
      a. Outline drawings of assembly.
      b. One line diagrams and wiring diagrams for assembly and components.
      c. Interconnection wiring diagrams.

B. Product Data:
   1. Technical data on each type of controller and/or feeder device.

C. Contract Closeout Information:
   1. Operating and maintenance data.
   2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Manual Controllers:
   1. Base:
      a. Eaton Electrical.
      b. Schneider Electric/Square D.
      c. Siemens.
      d. Allen-Bradley.
      e. General Electric.

B. Other manufacturers (not assemblers) desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. MOTORS:
   1. Verify all motor sizes and types of control from approved mechanical shop drawings.
   2. Motors 1/2 HP and above: 460V, three phase, 60 cycle; provide 3 phase combination magnetic starters.
   3. Do not provide starters if indicated as part of Mechanical Specifications Divisions work.
   4. Motors below 1/2 HP: 115V, single phase, 60 cycle; provide manual thermal element units.

B. MANUAL CONTROLLER
   1. Manual thermal element units: 120/240 volt, single phase, maximum 1 HP, with overload protection and toggle switch.
      a. Provide means for padlocking in off position.
      b. Eaton Electrical Type MS.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturer's recommendations and instructions.

B. Provide 4 IN high concrete pad under each motor control center.
   1. Install two 4 IN channel iron sills flush in pads to support and maintain alignment of each motor control center.
   2. See Division 03 for concrete.

C. Set adjustable trip settings of motor circuit protectors to match characteristics of motor installed.

D. Provide fuses in fusible devices as indicated.

E. Provide heater elements which match characteristics of motor installed.

3.2 LABELING

A. Provide labeling as specified in Section 26 00 10.

END OF SECTION

SECTION 26 27 26
WIRING DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Wiring Devices, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Provide wiring devices conforming to the following standards:
   1. Underwriter's Laboratories (UL).
      a. UL 20 – Standard for Safety for General-Use Snap Switches.
      b. UL 498 – Standard for Attachment Plugs and Receptacles.
      c. UL 514D – Cover Plates for Flush-Mounted Wiring Devices.
      d. UL 943 – Standard for Safety for Ground-Fault Circuit-Interrupters.
   2. National Electric Manufacturers Association (NEMA).
      a. WD-1 – General Color Requirements for Wiring Devices.
      b. WD-6 – Wiring Devices – Dimensional Requirements.
   3. US Federal Specifications.
      a. Fed Spec switches (WS-896E).
      b. Fed Spec receptacles (WC-596F).
      c. Fed Spec device plates (W-P-455).

1.3 SUBMITTALS

A. Product Data:
   1. Technical data on each type of device.

B. Contract Closeout Information:
   1. Warranty information.

1.4 WARRANTIES

A. Provide 5-year warranty on following devices:
   1. Occupancy sensors.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Wiring devices:
   1. Base:
      a. Hubbell.
   2. Optional:
      a. Cooper.
      b. Leviton Manufacturing.
      c. Pass & Seymour.
   3. All wiring devices shall be provided by the same manufacturer.

B. Explosion proof switches:
   1. Base:

a. Crouse-Hinds Lighting.

C. Dimmers:
1. Base:
a. Lutron.
2. Optional:
a. Prescolite.
b. Leviton Manufacturing.
3. Occupancy Sensors:
a. Base:
1) Wattstopper.
b. Optional:
1) Leviton Manufacturing.
2) Mytech.

D. Plug-in strip:
1. Base:
a. Wiremold.

E. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. SWITCHES:
1. Lighting switches:
a. Specification grade, quiet-operating toggle-type with back and side wiring, 120-277 volts, AC only, 20 amp rated unless otherwise indicated.
1) Switches shall be listed per UL 20 and certified by UL to Federal Specification WS-896E, and shall be visibly marked "Fed Spec WS-896".
2) All switches shall be equipped with a green grounding terminal.
b. Use ivory devices for "normal" circuits.
c. Use red devices for "emergency" and "optional stand-byl" circuits.
d. Refer to symbol legend.
2. Toggle-type switch:
a. Single-pole: Hubbell HBL1221.
b. Double-pole: Hubbell HBL1222.
c. Three-way: Hubbell HBL1223.
d. Four-way: Hubbell HBL1224.
e. Single-pole key switch: Hubbell 1221-L.
f. Red pilot light switch with illuminated toggle in the ON position: Hubbell HBL1221-PL.
g. Momentary contact double-throw, three position, center-off switch: Hubbell HBL1557.
h. Narrow switch for hollow metal jamb post, 15 amp rated: Arrow Hart QST-91 with mounting strap 1657.
3. Wall-box lighting dimmers:
a. All devices shall be UL listed specifically for the required loads (i.e., incandescent, fluorescent, low voltage, electronic low voltage). Universal dimmers are not acceptable.
b. Electronic solid-state type, rated for load, 120 and 277 volts AC.
c. All dimmers shall incorporate an air gap which shall be accessible without removing the faceplate. The air gap switch shall be capable of meeting all applicable requirements of UL 20 for air gap switches in dimmers.
d. All dimmers shall provide power failure memory. Should power be interrupted and subsequently returned, the light intensity will return to the same levels set prior to the power interruption.
e. Dimmers shall be tested to withstand voltage surges of up to 600 V and current surges of up to 200 A without damage per ANSI/IEEE Standard C62.41-1980.
f. Dimmers shall meet the UL 20 limited short circuit test requirement for snap switches.

g. Dimmer control shall be linear slide. Dimmer shall provide a smooth and continuous Square Law dimming curve.
h. Dimmer shall include voltage compensation circuitry that adjusts the firing angle of the dimmer in such a manner as to compensate light output for variations in AC line voltage.
i. Dimmer control slider shall not be capable of being removed without first removing the faceplate.
j. Faceplate shall snap on to the device with no visible means of attachment. Metal heat sink/mounting plate shall not be visible on front, top, bottom, or sides of device. At locations with multiple devices, one seamless, multi-gang faceplate shall be provided. Contractor is responsible for coordination of proper faceplate size and type.
k. Dimmers and faceplates shall be ivory.
l. Wall-box dimmers shall be Lutron Nova T style.

B. DUPLEX AND SINGLE RECEPTACLES
1. Receptacle outlets:
a. Specification grade.
b. Specification grade receptacles shall be listed per UL 498 for general use and certified by UL to Fed Spec WC-596F, and shall be visibly marked with the "UL-FS" mark to confirm certification.
1) Constructed with impact resistant nylon or polyester face and body.
2) 0.050 IN brass nickel-plated back strap with one piece (non-riveted) ground design.
3) 0.040 IN brass nickel-plated contacts.
c. Flush, grounding convenience outlets for side wiring, or side and back wiring.
d. Use ivory devices for "normal" circuits except as noted otherwise. The devices shown in the wood finishes and courtroom judge’s benches shall be black with black device plates. Coordinate with “EP” and E-400 sheets and interiors.
e. Use red devices on "emergency" and "optional stand-by" circuits.
f. Refer to symbol legend.
2. 20A, 125V, 2 pole, 3-wire grounding, duplex: NEMA 5-20R; Hubbell HBL5362.
3. 20A, 125V, 2 pole, 3-wire grounding, single; NEMA 5-20R; Hubbell HBL5361.
4. Weatherproof receptacles: Type as indicated on drawings.
a. Mount on "FS" cast metal box.
b. Suitable for wet location when receptacle is not in use.
1) Gasketed and self-closing lift cover.
a) Single outlets: Hubbell HBL7423 WO.
b) Duplex outlets: Hubbell HBL5206 WO.
c) Duplex GFI receptacles: Hubbell WPFS26.
5. GFI type duplex receptacles: With built-in ground fault interruption, 5-mA sensitivity, indicator and reset. UL listed.
a. 15A, 125V, 3-wire duplex: NEMA 5-15R; Hubbell GF5262.
b. 20A, 125V, 3-wire duplex: NEMA 5-20R; Hubbell GF5362.
6. Counter-top duplex receptacles: Similar to floor-mounted pedestal type.
7. Flush in-floor receptacles: 20A, 125V, 3 wire, grounding, back, and side wired NEMA 5-20R.
a. Dual level 4 IN round fully adjustable cast iron box.
1) Floors over 3 IN deep: Hubbell B-2536.
2) Floors 3 IN deep or less: Hubbell B-2537.
b. Round brass fitting cover, duplex screw: Hubbell S-3725.
c. Round brass carpet flange: Hubbell S-3182. Provide as required.
8. Isolated ground receptacles: Device type as indicated with receptacle ground isolated from conduit grounding system.
a. Orange device with orange device plate.
b. Specification grade, Hubbell IG-5262 and IG-5362.

C. SPECIAL PURPOSE RECEPTACLES

1. NEMA 6-20R receptacle: 20A, 250V, 2 pole, 3 wire grounding, side and back wired, single; ivory, Hubbell HBL5461I.
2. NEMA 14-20R receptacle: 20A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single; NEMA 14-20R; black; Hubbell HBL8410.
3. NEMA 15-20R receptacle: 20A, 250V, 3 pole, 4 wire, 3 phase grounding, single, black; Hubbell HBL8420.
4. NEMA 5-30R receptacle: 30A, 125V, 2 pole, 3 wire grounding, single, black; Hubbell HBL9308.
5. NEMA 6-30R receptacle: 30A, 250V, 2 pole, 3 wire grounding, single, black; Hubbell HBL9330.
6. NEMA 10-30R receptacle: 30A, 125/250V, 3 pole, 3 wire, 1 phase, single, brown; Hubbell HBL9350.
7. NEMA 14-30R receptacle: 30A, 125/250V, 3 pole, 4 wire, 1 phase grounding, single, black; Hubbell HBL9430A.
8. NEMA 15-30R receptacle: 30A, 250V, 3 pole, 4 wire, 3 phase, grounding, single, black; Hubbell HBL8430A.

D. DEVICE PLATES
1. Device plates for concealed wiring: Same manufacturer as devices to suit device covered; single, or ganged, in one piece with beveled edges that match faces of plates.
   a. Flush impact resistant nylon wall plate for those installed in wood finishes: Color to match device covered.
   b. Flush, brushed-finish, type 304 stainless steel to match existing in all other areas unless other wise noted.
2. Labeling:
   a. General:
      1) Where labeling of device plates is required provide engraved laminated nameplate or engraved device plate.
   b. Permanently label device plates for all receptacles connected to optional stand-by electrical system to indicate panelboard and circuit number supplying them.
3. Device plates for surface type cast-metal boxes: Corrosion resistant cast ferrous metal designed for application.

E. PLUG-IN STRIP
1. Plug-in strip: Surface steel raceway plug-in strip with pre-wired receptacles.
   a. Base, snap-on cover, and fittings as required.
   b. Ivory baked enamel.
   c. Provide single 15 amp, 125V, 3 wire, grounding type, specification grade receptacles.
   d. Space receptacles 12 IN OC.
   e. Nominal dimensions 1-1/4 IN wide x 3/4 IN deep.
   f. UL listed under ANSI/UL-5.
   g. Conductors: TW or THHN, 2 No.12 and 1 No.12 TW green for connection to receptacle grounding terminals. Effectively connect green grounding conductor and raceway to building equipment grounding system.
   h. Wiremold Type 2000 Plugmold.
2. Plug-in strip: Surface aluminum raceway plug-in strip with pre-wired receptacles.
   a. Base, snap-on cover and fittings as required.
   b. Type 6063-T5 extruded aluminum alloy 0.060 IN thick with 0.004 IN clear satin anodized finish.
   c. Provide single 15 amp, 125V, 3 wire, grounding type, specification grade receptacles.
   d. Space receptacles IN OC.
   e. Nominal dimensions 1-7/16 IN wide x 1-1/8 IN deep.
   f. UL listed under ANSI/UL-5.
   g. Conductors: TW or THHN, 2 No.12 and 1 No.12 TW green for connection to receptacle grounding terminals. Effectively connect green grounding conductor and raceway to building equipment grounding system.

h. Wiremold Type AL2000 Plugmold.

F. OCCUPANCY SENSORS

1. Passive Infrared Ceiling Sensor:
   a. The passive infrared sensor shall be capable of detecting presence in the control area by detecting changes in the infrared energy. The unit shall examine the frequency, duration, and amplitude of the signal received by the sensor to respond only to those signals caused by human motion.
   b. Sensor shall combine analog and digital processing to provide immunity to RFI and EMI.
   c. Sensor shall utilize a temperature compensated, dual element sensor, and a multi-element Fresnel lens with a field of view of 110 degrees.
   d. Sensor shall cover 300 SQFT at normal mounting heights and shall have the ability to sense directly under and slightly behind sensor when mounted on ceiling.
   e. Time delay range shall be adjustable from 30 seconds to 30 minutes, and shall have user-adjustable sensitivity setting.
   f. Sensor shall have in place a bypass pin which when removed will override sensor to ON and which requires no rewiring or modification to unit. Adjustments and mounting hardware shall be concealed under a removable cover.
   g. Sensor shall not protrude more than 1-1/4 IN from ceiling.
   h. Sensor shall be capable of being wired in parallel to allow coverage of large areas.
   i. Wattstopper Model WPIR.
2. Passive Infrared Wall Switch:
   a. The passive infrared sensor shall be a completely self-contained control system that replaces a standard toggle switch. Switching mechanism shall be a latching air gap relay, compatible with electronic ballasts, compact fluorescent and inductive loads. Sensor shall be capable of detecting presence in the control area by detecting changes in the infrared energy. The unit shall examine the frequency, duration, and amplitude of the signal received by the sensor to ensure response only to those signals caused by human motion.
   b. Sensor shall combine analog and digital processing to provide immunity to RFI and EMI.
   c. Sensor shall utilize a temperature compensated, dual element sensor, and a multi-element Fresnel lens.
   d. Sensor shall cover up to 300 SQFT for walking motion, with a field of view of 180 degrees.
   e. Sensor shall operate at either 120 VAC or 277 VAC. Sensor shall have no minimum load requirement and shall be capable of switching 0 to 500 watts incandescent, 0 to 800 watts fluorescent or 1/6 hp at 120 VAC, 60 Hz; 0 to 1200 watts fluorescent or 1/3 hp at 277 VAC, 60 Hz.
   f. Sensor shall have a DIP switch to control the following functions:
      1) Built-in light level feature adjustable from 8 to 180-foot candles.
      2) Automatic-ON or manual-ON operation.
      3) Time delay adjustable from 30 seconds to 30 minutes.
      4) High/low sensitivity adjustments.
   g. Adjustments and mounting hardware shall be concealed under a removable, tamper resistant cover.
   h. Sensor shall not protrude more than 3/8 IN from the wall.
   i. For normal operation, sensor shall have two positions only: OFF and AUTO.
   j. Wattstopper Model WA-100.
3. Ultrasonic Ceiling Sensor:
   a. The ultrasonic occupancy sensors shall be capable of detecting presence in the floor area to be controlled by detecting doppler shifts in transmitted ultrasound.
   b. Ultrasonic sensing shall be volumetric in coverage with a frequency of 32 kHz and shall automatically adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled areas.

c. Sensors shall have temperature and humidity resistant, 32 kHz tuned ultrasonic receivers. Receivers shall have less than a 6dB shift in the humidity range of 10% to 90% and less than a 10dB shift in the temperature range of -20 to 60 degC.
d. Sensor shall have a DIP switch to control the following functions:
   1) Override-ON function for use in the event of failure.
   2) Time delay adjustable from 15 seconds to 30 minutes.
   3) High/low sensitivity adjustments.
e. Sensors shall not protrude more than 1.50 IN from ceiling.
f. Sensors shall cover 360 deg and hallway and corridor sensors shall cover up to 90 linear feet.
g. The sensor shall have an additional single-pole, double-throw isolated relay with normally open, normally closed, and common outputs rated at 1 amp for 24 VDC. The isolated relay is for use with HVAC control, data logging, and other control options.
h. Wattstopper Model WT-600 for coverage up to 600 SQFT.

4. Power Pack:
   a. Power pack shall be a self-contained transformer and relay module-measuring 1.75 IN x 2.75 IN x 1.5 IN.
   b. Power and slave packs shall have dry contacts capable of switching 20-amp ballast load, 13 amp incandescent, 1 hp @ 120 VAC, 60 Hz; 20 amp ballast @ 277 VAC, 60 Hz.
   c. Power pack shall provide a 24 VDC, 100 mA output.
   d. Power packs shall be capable of parallel wiring without regard to AC phases on primary.
   e. Power pack can be used as a stand-alone, low voltage switch, or can be wired to sensor for auto control.
   f. Power pack shall have low voltage Teflon coated leads, rated for 300 volts, suitable for use in plenum applications.
   g. Wattstopper Models A120E-P and A277E-P.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Locate devices as indicated and as scheduled in Section 26 00 10.

B. Center outlets with regard to paneling, furring, trim, etc.

C. Where several outlets occur in a room, symmetrically arrange them.

D. Any outlet which is improperly located must be corrected at Contractor's expense.

E. Set outlets plumb or horizontal and extending to finished surface of wall, ceiling or floor as case may be without projecting beyond same.

F. Install receptacles, switches, etc., indicated on wood trim, cases or other fixtures symmetrically. Where necessary, set with long dimension of plate horizontal, or gang in tandem.

G. GFCI Receptacles shall be connected to provide ground fault protection of downstream devices within 6 FT of sinks. All other downstream device shall not be protected by GFCI receptacle.
   1. All protected downstream devices shall be labeled as protected by upstream GFCI receptacle.

H. Occupancy Sensors:
   1. The locations and quantity of sensors shown on the drawings are diagrammatic and indicate only the rooms and spaces to be provided with sensors.
   2. Verify sensor type, quantity, location, aiming, and sensitivity with manufacturer's recommendations.

3. All controlled spaces shall be tested to insure 90 to 100 percent coverage of the controlled space. If test fails, adjust sensitivity, re-aim, relocate, and/or add sensor(s) as required at no cost to Owner.
4. Power supplies and slave units if required shall be located above accessible ceilings.

END OF SECTION

SECTION 26 28 00
OVERCURRENT PROTECTIVE DEVICES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Overcurrent Protective Devices, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. System standards:
   1. NEMA AB 1 1993 - (National Electrical Manufacturers Association) Molded Case Circuit Breakers and Molded Case Switches
   2. UL 489 - (Underwriters Laboratories Inc.) Molded Case Circuit Breakers and Circuit Breaker Enclosures
   3. UL 943 - Standard for Ground Fault Circuit Interrupters
   4. CSA C22.2 No. 5.1 - M91 - (Canadian Standard Association) Molded Case Circuit Breakers
   5. Federal Specification W-C-375B/GEN - Circuit Breakers, Molded Case; Branch Circuit and Service
   6. All power circuit breakers shall be constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standard.
   7. IEEE 141(Red Book) – Recommended Practice for Electric Power Distribution for Industrial Plants.
   8. IEEE 399 (Brown Book) – Recommended Practice for Industrial and Commercial Power Systems Analysis.
   9. IEEE 1584 – Guide for Performing Arc-Flash Hazard Calculations.
   10. NFPA 70E – Standard for Electrical Safety Requirements for Employee Workplaces.
   11. IEEE 519 – Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems

1.3 SUBMITTALS

A. Shop Drawings:
   1. Power system study:
      a. Submittal 1:
         1) Prior to or at same time as distribution equipment shop drawings and prior to release of equipment for manufacturer. No distribution equipment shall be released for manufacture until Engineer has reviewed and approved power system study submittal 1. Submittal 1 to include preliminary:
            a) Short circuit study.
      b. Submittal 2:
         1) Field verify conductor lengths after installation. Update power system study with actual installed equipment, conductor lengths and any changes in conductor sizes. Submit updated study at least 3 months prior to applying final settings for testing and 6 months prior to substantial completion of project. Include any recommended changes in Submittal 2. Submittal 2 to include final:
            a) Short circuit study.
            b) Coordination study.
            c) Arc flash study.
            d) Harmonics study.

c. To be performed by independent, third party firm or by manufacturer of electrical distribution equipment. Study to be stamped and signed by registered professional engineer. Submit credentials of individual(s) performing study and background of firm for approval prior to start of work. Minimum of five years experience in high and low voltage power system analysis is required for individual in charge of producing study.
d. Provide computer generated system one-line diagram clearly identifying individual equipment buses, bus numbers, device numbers and maximum available short-circuit current at each bus.
e. Use specified conductor sizes and estimated conductor lengths for shop drawing.
f. Short circuit study:
    1) Provide calculation methods and assumptions, base per unit quantities selected, one-line diagrams, source impedance data including utility company system characteristics, typical calculations, tabulations of calculation quantities and results, conclusions and recommendations.
    2) Notify Engineer in writing of equipment not properly rated for fault conditions. Identify any prohibited operating/switching scenarios that would over-duty certain identified equipment.
g. Coordination study:
    1) Provide determination of settings, ratings, or types for overcurrent protective devices supplied. Where necessary, appropriate compromise shall be made with system protection and service continuity considered to be of equal importance.
    2) Breakers shall be set to trip as quickly as possible without compromising overall coordination to limit arc flash hazard energy to the lowest level possible.
    3) Provide sufficient number of log-log plots to indicate degree of system protection and coordination. Log-log plots shall include transformer ANSI withstand points and inrush currents of transformers and motors where appropriate.
    4) Computer printouts or equivalent tabular format to accompany log-log plots containing descriptions for all devices indicated on plot, settings of adjustable devices, device numbers to simplify location of devices on system one-line diagram.
    5) Provide data in tabular format of suggested settings of adjustable overcurrent protective devices, equipment where each device is located, device number corresponding to device on system one-line diagram, and number of time-current log-log plots where they are illustrated. Similar or like devices may be illustrated by using “typical” plots. Every device need not be separately illustrated.
    6) Provide discussion section evaluating degree of system protection and system continuity with overcurrent devices, with recommendations as required for increased protection or coordination.
    7) Include complete title and one-line diagram with legend with each curve sheet identifying specific portion of system covered by that particular curve sheet.
    8) Include detailed description of each protective device identifying its type, function, manufacturer and time-current characteristics.
    9) Tabulate recommended device tap, time dial, pickup, instantaneous and time delay settings.
    10) Provide time-current curves graphically indicating coordination proposed for system, centered on 8.5 x 11 IN, log-log forms.
    11) Any inadequacies shall be called to attention of Engineer and recommendations shall be made for improvements.
h. Arc flash study:
    1) Provide arc flash study in conjunction with short circuit and protective device coordination study.
    2) Include all electrical distribution equipment in study including but not limited to:
        a) Switchgear and switchboards.
        b) Distribution and branch circuit panel boards.
        c) Motor control centers.
        d) Individual circuit breakers, disconnect switches and molded case switches,

e) Utilization equipment with integral disconnects or panels such as variable frequency drives, packaged mechanical equipment and UPS.
f) Automatic transfer switches.

3) Arc flash boundary distances and incident energy at each device shall be determined by worst case incident energy at that device resulting from maximum and minimum available fault current at main distribution switchgear or switchboard for each valid system operating/switching mode under all probable source conditions. For low voltage equipment (600 volt and below), incident energy calculations shall be made at 100 percent and 85 percent arcing current per IEEE 1584.
4) Provide tabulation of data for each bus analyzed.

i. Harmonics study:
1) Submit scope, process, basis of calculations, data collection, assumption, etc.
2) Perform complete Preliminary Harmonic Analysis based on approved equipment and compare results with specified criteria.
3) If criteria is not achieved provide recommendations on additional harmonics mitigation.
4) Perform additional Harmonic Analysis based on recommendations that achieve specified criteria.
5) Include discussion on potential impact(s) if recommendations are not implemented.

B. Product Data:
1. Technical data on each type of device including:
a. Outline drawings with dimensions.
b. Ratings for voltage, amperage and maximum interrupting ratings.
c. Trip unit functions and adjustments
d. Accessories.
e. Wiring diagrams.
f. Manufacturer shall provide hard copy time/current characteristic trip curves (and Ip & I^2t let through curves for current limiting circuit breakers) for each type of circuit breaker.
2. Submit with associated switchgear, switchboard, panelboard or other assembly.

C. Contract Closeout Information:
1. Operating and maintenance data.
a. Include instructions for circuit breaker mounting, trip unit functions and adjustments, trouble shooting, accessories and wiring diagrams.
2. Final power system study based on actual installed equipment, field measured conductor lengths and any applicable modifications to contract documents.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Overcurrent protective devices.
1. Base:
a. Eaton Electric.
b. Schneider Electric/Square D.
c. Siemens.
d. General Electric.

B. Fuses:
1. Base:
a. Bussmann.
b. Ferraz Shawmut.
c. Brush.

d. Littelfuse.

C. Equipment and devices by same manufacturer.

D. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 MATERIALS

A. Circuit Breakers
1. General:
a. Provide circuit breakers as required by other specifications and drawings. Provide special features as indicated including but not limited to:
1) Drawout construction.
2) Electrical operation.
3) Key interlock for main-tie-main arrangements.
4) Ground fault protection.
b. Provide lugs rated for 75 degree C wire minimum.
c. Contractor shall review one line diagrams and confirm that circuit breakers have adequate lugs to accommodate size and quantity of conductors indicated on one line diagrams, panel and motor control schedules.
d. Lugs shall be UL Listed to accept solid (not larger than #8 AWG) and/or stranded copper and aluminum conductors.
e. Circuit breakers shall be capable of accepting bus connections.
f. Overcurrent devices shall be fully rated for available fault current unless otherwise specifically indicated.
2. Molded case type
a. General:
1) Constructed of glass reinforced insulating material. Current carrying components shall be completely isolated from handle and accessory mounting area.
2) Provide over center, trip free, toggle operating mechanism which shall provide quick-make, quick-break contact action. Provide common tripping of two and three pole circuit breakers.
3) Circuit breaker handle shall reside in a tripped position between ON and OFF to provide local trip indication. Circuit breaker escutcheon shall be clearly marked ON and OFF in addition to providing International I/O markings.
4) Maximum ampere rating and UL, IEC, or other certification standards with applicable voltage systems and corresponding interrupting ratings shall be clearly marked on face of circuit breaker.
5) Provide each circuit breaker with push-to-trip button, located on face of circuit breaker to mechanically operate circuit breaker tripping mechanism for maintenance and testing purposes.
6) Provide factory seal with date code on face of circuit breaker.
7) Provide circuit breakers equipped with UL Listed electrical accessories as noted on associated schedule or drawing.
8) Provide circuit breaker handle accessories with provisions for locking handle in ON and OFF position as noted on associated schedule or drawing.
9) Provide circuit breakers UL Listed for reverse connection without restrictive line and load markings and suitable for mounting in any position.
10) Provide circuit breakers UL Listed to accept field installable/removable mechanical type or compression type lugs. Provide lug body bolted in place; snap in design not acceptable.
b. Thermal-Magnetic Circuit Breakers:
1) Used only as follows unless otherwise indicated:
a) Main, feeder and branch circuit breakers in lighting and appliance panelboards as defined in Section 26 24 16.
b) Main, feeder and branch circuit breakers rated 125 amps and less in distribution panel boards as defined in Section 26 24 16.

c) Motor circuit protectors.

2) Do not use in switchboards rated over 1200 amps.

3) Provide permanent trip unit containing individual thermal and magnetic trip elements in each pole.

4) Thermal trip elements shall be factory preset and sealed. Circuit breakers shall be true rms sensing and thermally responsive to protect circuit conductor(s) in a 40° C ambient temperature.

5) Provide circuit breaker frame sizes above 150 amperes with magnetic trip adjustment located on front of circuit breaker.

6) Provide UL Listed HACR type for two- and three-pole circuit breakers rated up to 250 amperes at 600 VAC.

7) Provide Class A (5 ma) sensitivity breaker where GFCI circuit breakers are indicated.

8) Provide equipment ground fault protection where indicated with following provisions:

a) Modified zero sequence sensing system.

b) Ground fault sensing system:

(1) Requiring no external power to trip circuit breaker.

(2) Suitable for use on grounded systems and suitable for use on three-phase, three-wire circuits where system neutral is grounded but not carried through system or on three-phase, four-wire systems.

(3) Include ground fault memory circuit to sum time increments of intermittent arcing ground faults above pickup point.

(4) Shall not affect interrupting rating of companion circuit breaker.

c) Companion circuit breaker equipped with ground-fault shunt trip and capable of group mounting.

d) Field adjustable Ground fault pickup current setting and time delay with switch for setting ground fault pickup point and means to seal pickup and delay adjustments.

e) Means of testing ground fault system to meet on-site testing requirements of NEC.

f) Local visual ground fault trip indication.

c. Electronic trip circuit breakers with standard function trip system

1) Provide standard function trip system on circuit breakers rated less than 400 amps unless otherwise indicated.

2) Provide circuit breaker trip system with microprocessor-based true rms sensing design with sensing accuracy through thirteenth (13th) harmonic and sensor ampere ratings as indicated on associated schedules or drawings.

3) Provide integral trip system independent of any external power source and with industrial grade electronic components.

4) Determine ampere rating of circuit breaker by combination of interchangeable rating plug, sensor size and long-time pickup adjustment on circuit breaker. Clearly mark sensor size, rating plug and adjustment positions on face of circuit breaker.

5) Provide circuit breakers UL listed to carry 80 percent of ampere rating continuously.

6) Provide following time/current response adjustments, each with discrete settings independent from other adjustments:

a) Instantaneous Pickup.

b) Long time tpckup and delay.

c) Short time pickup.

d) Short time delay (I^2t IN only).

e) Ground fault pickup and delay (I^2t OUT only) where indicated.

7) Provide means to seal trip unit adjustments in accordance with NEC..

8) Provide local visual trip indication for overload, short circuit and ground fault trip occurrences as applicable.

9) Provide ammeter to individually display all phase currents flowing through circuit breaker including indication of inherent ground fault current flowing in system on circuit breakers with integral ground fault protection. Display current values in true rms with 2 percent accuracy.
10) Provide Long Time Pickup indication to signal when loading approaches or exceeds adjusted ampere rating of circuit breaker.
11) Provide trip system with Long Time memory circuit to sum time increments of intermittent overcurrent conditions above pickup point and means to reset Long Time memory circuit during primary injection testing.
12) Provide circuit breakers equipped with thermal protection in trip unit to protect breaker from catastrophic failure and instantaneous magnetic override set at the withstand rating of the circuit breaker.
13) Provide trip system equipped with externally accessible test port for use with Universal Test Set. Disassembly of circuit breaker shall not be required for testing. Provide test set capable of verifying operation of trip functions with or without tripping circuit breaker.

d. Electronic trip circuit breakers with full function trip system:
1) Provide full function trip system on circuit breakers rated 400 amps and greater.
2) Provide circuit breaker trip system with microprocessor-based true rms sensing design with sensing accuracy through thirteenth (13th) harmonic and sensor ampere ratings as indicated on associated schedules or drawings.
3) Provide integral trip system independent of any external power source and with industrial grade electronic components.
4) Determine ampere rating of circuit breaker by combination of interchangeable rating plug, sensor size and long-time pickup adjustment on circuit breaker. Clearly mark sensor size, rating plug and adjustment positions on face of circuit breaker.
5) Provide circuit breakers UL listed to carry 80 percent of ampere rating continuously.
6) Provide following time/current response adjustments, each with discrete settings independent from other adjustments:
a) Instantaneous pickup.
b) Long time pickup and delay.
c) Short time pickup.
d) Short time delay (I^2t IN and I^2t OUT).
e) Ground fault pickup and delay (I^2t IN and I^2t OUT) where indicated.
f) Ground fault alarm only where required by NEC.
7) Provide means to seal rating plug and trip unit adjustments in accordance with NEC.
8) Provide ammeter to individually display all phase currents flowing through circuit breaker including indication of inherent ground fault current flowing in system on circuit breakers with integral ground fault protection. Display current values in true rms with 2 percent accuracy.
9) Provide Long Time Pickup indication to signal when loading approaches or exceeds adjusted ampere rating of circuit breaker.
10) Provide trip system with Long Time memory circuit to sum time increments of intermittent overcurrent conditions above pickup point and means to reset Long Time memory circuit during primary injection testing.
11) Provide circuit breakers equipped with thermal protection in trip unit to protect breaker from catastrophic failure and instantaneous magnetic override set at the withstand rating of the circuit breaker.
12) Provide trip system equipped with externally accessible test port for use with Universal Test Set. Disassembly of circuit breaker shall not be required for testing. Provide test set capable of verifying operation of trip functions with or without tripping circuit breaker.

13) Provide communications capabilities for remote monitoring of circuit breaker trip system, to include phase and ground fault currents, pre-trip alarm indication, switch settings, and trip history information. Required communications protocol(s):

e. Equipment Ground Fault Protection (Electronic Trip Circuit Breakers)
   1) Provide circuit breakers with integral equipment ground fault protection where indicated for grounded systems. Provide circuit breaker suitable for use on three-phase, three-wire circuits where system neutral is grounded but not carried through system or on three-phase, four-wire systems.
   2) Provide separate neutral current transformer for three-phase four-wire systems as indicated on schedules or drawings.
   3) Provide ground fault sensing system with residual sensing, source ground return or modified differential type.
   4) Provide trip system with ground fault memory circuit to sum time increments of intermittent ground faults above pickup point.
   5) Provide means of testing ground fault system to meet on-site testing requirements of NEC.
   6) Provide local visual trip indication for ground fault trip occurrence(s).

3. Electronic trip power circuit breakers with full feature trip system and following provisions:
   a. Constructed and tested in accordance with ANSI C37.13, C37.16, C37.17, C37.50, UL 1066 and NEMA SG-3 standard.
   b. Draw-out or fixed mounting as indicated.
   c. Manually operated or electrically operated as indicated.
   d. Suitable for required instantaneous rating without use of current limiting fuses.
   e. Field interchangeable electrical accessories including shunt trip, spring release, electrical operator, auxiliary contacts and Trip Unit.
   f. Secondary connections made directly to front of circuit breaker cradle.
   g. Built-in contact temperature and contact wear sensors.
   h. Padlocking provisions to receive up to three padlocks when circuit breaker is in disconnected position, positively preventing unauthorized closing of circuit breaker contacts.
   i. Up to two key locks allowing locking in disconnected position.
   j. Capability for locking in connected, test and disconnected positions by padlock or key lock.
   k. Buttons on face of circuit breaker, with lockable clear cover, to open and close circuit breaker and indicators to show:
      1) Position of circuit breaker contacts.
      2) Status of closing springs
      3) Circuit breaker position in cell.
   l. Indicator to show “charged–not OK to close” if closing springs are charged but circuit breaker is not ready to close.
   m. Circuit breaker racking system with positive stops at connected, test, disconnected and withdrawn positions.
   n. Circuit breaker equipped with interlock to discharge stored energy spring before circuit breaker can be withdrawn from its cell.
   o. Positive ground contact check between circuit breaker and cell when accessory cover is removed while circuit breaker is in connected, test or disconnected positions.
   p. Trip Units:
      1) Removable to allow for field upgrades.
      2) Incorporate “True RMS Sensing” and LED long-time pickup indications.
      3) Provide following time/current response adjustments, each with discrete settings independent from other adjustments.
         a) Instantaneous pick-up including “OFF” setting.
         b) Long-time pickup and delay (adjustable and field-replaceble).
         c) Short-time pickup.
         d) Short-time delay (I^2t IN and I^2t OUT).

e) Ground fault pickup and delay (I^2t IN and I^2t OUT) where indicated.
f) Ground-fault protection shall be available for solidly grounded three-phase, three-wire or three-phase, four-wire systems. Trip unit shall be capable of residual, source ground return, and modified differential ground fault protection. Ground-fault sensing systems shall be field-modifiable. Provide where indicated.
g) Ground fault alarm only pickup where required by NEC.

4) Provide capability for adjustments to be set and read locally by rotating a switch.
5) Provide local trip indication and capability to indicate local and remote reason for trip, i.e., overload, short circuit or ground fault as applicable.
6) Provide neutral current transformers for four-wire systems.
7) Capable of communicating on **MODBUS** ® networks.
8) Provide real time metering. Metering functions include current, voltage, power and frequency.
9) Provide harmonic waveform capture.

4. Electronic trip power circuit breakers with full feature trip system and following provisions:
   a. Provide circuit breaker racking system for draw out applications. Equip breaker cell with draw out rails and primary and secondary disconnecting contacts with following provisions:
   b. Provide ten (10) front-mounted dedicated secondary wiring points. Each wiring point shall have finger safe contacts, which will accommodate #10 AWG maximum field connections with ring tongue or spade terminals or bare wire.
   c. Trip units:
5. Motor circuit protector (MCP) with adjustable instantaneous short circuit protection only by means of a magnetic or solid state trip element.
   a. Molded case construction.
   b. Current-limiting as indicated or required providing 200,000 AIC by means of a current-limiter attachment.
   c. See motor control center schedules for required sizes and interrupting ratings.

B. Individually Enclosed Circuit Breakers
1. Provide circuit breakers of types specified herein and mounted in individual listed enclosures.
   a. Rate enclosures NEMA 1 unless otherwise indicated.
   b. Flush mount enclosures located in finished areas unless otherwise indicated. Coordinate depth of enclosure with wall depth. Install enclosure cover flush with finished wall. Advise Engineer if enclosure is too deep for available wall depth prior to installation of enclosure.

C. Fuses
1. UL Class L fuses: Dual-element time-delay and current-limiting type fuses; UL Class L listed for 200,000 rms AIC symmetrical; Bussmann "Low-Peak" 600V, 601-6000A, Type KRP-C.
   a. Use for main and main feeder devices over 600A, where fuses are indicated.
2. UL Class RK-1 dual-element fuses: Dual-element time-delay and current-limiting rejection type fuses; UL Class RK-1 listed for 200,000 rms AIC symmetrical; Bussmann "Low-Peak" 0-600A, 250V Type LPN-RK and 600V Type LPS-RK.
   a. Use for main feeder devices 600A and smaller where fuses are indicated.
3. UL Class RK-1 single-element fuses: Fast-acting current-limiting rejection type fuses; UL Class RK-1 listed for 200,000 rms AIC symmetrical; Bussmann "Limitron" 1/10-600A, 250V Type KTN-RK and 600V Type KTS-RK.
   a. Use as indicated.
4. UL Class RK-5 fuses: Dual-element time-delay and current-limiting rejection type fuses; UL Class RK-5 listed for 200,000 rms AIC; Bussmann "Fusetron" 1/10-600A, 250V Type FRN-RK and 600V FRS-RK.
   a. Use for motor feeder and branch circuit devices where fuses are indicated.

5. Elevator fuses: Type and rating as required by elevator manufacturer. Confirm requirements with elevator manufacturer prior to ordering fuses.

D. Fusible Switches
1. Provide panelboard type suitable for mounting in switchboards or panelboards as indicated.
   a. 200,000 AIC, 30 thru 1200 A, with fuses specified above.
   b. Provide ground fault protection system with current sensor, shunt trip and control power transformer where indicated.
2. Provide bolted pressure contact switches suitable for mounting in switchboards as indicated.
   a. 200,000 AIC, 800 thru 4000 A, with fuses specified above.
   b. Electrically operated as indicated.
   c. Provide ground fault protection with current sensor, shunt trip and control power transformer where indicated.

2.3 POWER SYSTEM STUDY

A. Provide computer generated power system study of specified electrical power distribution system in accordance with IEEE 141 and 399.
1. Include electrical distribution system from main distribution equipment (including utility and generator sources) down to each 208 volt branch circuit panelboard. Study shall include each valid system operating/switching mode under all probable source conditions.
2. Data collection:
   a. Provide required data for preparation of studies. Performer of studies shall furnish contractor with listing of required data immediately after award of contract.
   b. Expedite collection of data to assure completion of studies as required for final approval of equipment shop drawings.
   c. Input data shall include power company's short circuit contribution as calculated and verified by them.
   d. Verify characteristics of utility service overcurrent devices with power company.

B. Analysis shall include:
1. Short circuit study:
   a. Scenarios that result in maximum fault conditions shall be adequately covered in study. For example, if closed transition transfer switches are provided or if utility is paralleled with standby generators at any time, combined contribution from utility and generators shall be considered.
   b. Include complete fault calculations as specified herein for each proposed and ultimate source combination. Note that source combinations may include present and future supply circuits, large motors and/or generators.
   c. Calculate 1/2 cycle (or 5 cycle where appropriate for MV equipment) short circuit interrupting and momentary (asymmetrical 'close and latch') duties, when applicable for an assumed 3-phase bolted fault at each load interrupter switchgear, transformer primary and secondary terminals, low-voltage switchgear, switchboard, distribution panelboards, bus duct, automatic transfer switch, motor control center, 480 volt panelboard, 208 volt panelboard and other significant locations throughout system.
   d. Include equipment/device ratings, X to R ratios and symmetrical fault currents in tabulations. Where actual (calculated) X/R ratio exceeds device test X/R ratio, appropriate fault duty adjustment shall be made in accordance with ANSI/IEEE standards and included in tabulations.
   e. Base transformer impedance on lowest tolerance limit allowed by ANSI C57.12 (7.5 percent below listed value). Use actual nameplate impedance when available.
   f. Include fault contribution of all motors.
2. Coordination study:
   a. All potential scenarios shall be considered in study. Scenarios to be considered include but are not limited to:
      1) For basic system with single service, study shall show coordination between main, feeders and downstream devices.

2) If main switchgear or switchboard is double-ended with main-tie-main arrangement, study shall show coordination between main, tie, feeders and downstream devices when tie breaker is closed. Where overlap cannot be avoided, tie breaker shall be set to overlap downstream feeder overcurrent devices rather than main devices.
3) If multiple levels of ground fault are provided time current curves shall be provided that indicate coordination of ground fault between main, tie and feeder breakers when tie breaker is closed. Where overlap cannot be avoided, tie breaker shall be set to overlap downstream feeder overcurrent devices rather than main devices.
4) Provide graph to indicate coordination between typical 20 amp, 277 volt, single pole breaker and nearest upstream 480 volt overcurrent device with ground fault protection as applicable.
5) Evaluate proper operation of ground relays in 4-wire distributions with more than one main service circuit breaker, or when generators are provided. Discuss neutral grounds and ground fault current flows during a neutral to ground fault.
6) Include phase and ground coordination of generator protective devices. Indicate generator decrement curve and damage curve along with operating characteristic of protective devices. Obtain information from generator manufacturer and include generator actual impedance value, time constants and current boost data in study. Do not use typical values for generator.
7) For motor control circuits, indicate distribution equipment full-load current plus symmetrical and asymmetrical of largest motor starting current and time to ensure protective devices will not trip during major or group start operation.
8) All emergency system overcurrent protective devices shall fully coordinate per applicable requirements of NEC. Where this is not possible due to pre-determined device types, sizing or trip unit selections, notify Engineer immediately of inadequacies and include recommendations for resolution.

b. Graphs shall include as applicable:
1) Utility relay and fuse characteristics.
2) Campus substation relay and fuse characteristics.
3) Medium-voltage equipment relay and fuse characteristics.
4) Low-voltage equipment circuit breaker trip device characteristics.
5) Pertinent transformer characteristics.
6) Pertinent motor and generator characteristics.
7) Characteristics of other system load protective devices.
8) All devices down to and including largest branch circuit overcurrent protective device in each motor control center, distribution panel and branch panelboard.
9) All adjustable settings for ground fault protective devices.
10) Manufacturing tolerance and damage bands in plotted fuse characteristics.

c. Indicate transformer full load and 150, 400 or 600 percent currents, transformer magnetizing inrush, ANSI transformer withstand parameters and significant symmetrical and asymmetrical fault currents.

d. Select each primary protective device required for delta-wye connected transformer so that its characteristic or operating band is within transformer characteristics including point equal to 58 percent of ANSI withstand point to provide secondary line-to-ground fault protection. Where primary device characteristic is not within transformer characteristics, indicate transformer damage curve.

e. Terminate device characteristic curves at point reflecting maximum symmetrical or asymmetrical fault current to which device could be exposed.

3. Arc flash study:
a. Arc flash analysis shall be performed in accordance with NFPA 70E with calculations performed in accordance with IEEE 1584A.
b. Provide following data for each bus analyzed.
1) Flash Bus Name.
2) Protective Device Name.
3) Bus Operating Fault Current.

4) Protective Device Bolted Fault Current.
5) Protective Device Arcing Fault Current.
6) Trip/Delay Time (SEC).
7) Breaker Opening Time (SEC).
8) Ground.
9) Equipment Type.
10) Gap (mm).
11) ARC Flash Boundary (IN).
12) Working Distance (IN) consistent with Owner's arc flash policy.
13) Incident Energy (CAL/cm^2)
14) Required Protective FR Clothing (PPE) Category.

c. Provide following data on each arc flash hazard warning label:
1) Flash Hazard Protection Boundary.
2) Incident Energy Level.
3) Required Personal Protective Equipment Category with brief description.
4) Shock hazard when cover is removed.
5) Limited Approach Boundary.
6) Restricted Approach Boundary.
7) Prohibited Approach Boundary.
8) Include date of calculation, utility short circuit capacity and voltage as of that date.

4. Harmonic study:
a. Provide harmonic study to predict as accurately as possible voltage and current harmonic distortion including line notching at point of common couple. Analysis shall conform to IEEE 519.
b. Harmonic distortion criteria shall be as follows:
1) Maximum voltage total harmonic distortion: 3 percent.
2) Maximum voltage line notch depth: 10 percent.
3) Maximum voltage line notch area: 16,400 V-mS.
4) Maximum current total harmonic distortion: 5 percent with individual harmonics as follows:
a) 1 through 10: 4.0 percent.
b) 11 through 16: 2.0 percent.
c) 17 through 22: 1.5 percent.
d) 23 through 34: 0.6 percent.
e) 35: 0.3 percent.
5) Harmonic sources shall include but not be limited to:
a) Variable frequency drives: Use harmonic profiles obtained from VFD manufacture's testing.
b) Uninterruptible power supplies: Use harmonic profiles obtained from UPS manufacture's testing.
c) Lighting ballast: Use standard harmonic profiles for ballast similar to ballasts used on this project.
d) Receptacle loads: Assume that 10 percent of receptacles will be serving electronic loads with high harmonic content similar to personal computers.
6) Base calculations on following:
a) Point of common couple:
(1) Normal distribution systems: Each main low voltage switchboard or switchgear bus indicated on one line diagram(s).
(2) Emergency distribution system: Generator main low voltage switchboard or switchgear bus.
b) Verify transformer and generator impedance with proposed equipment.
c) Primary UPS units serving 100 percent non-linear loads and redundant units on-line but not serving any load.
d) Add an additional 25 percent VFD controlled motor load to each bus serving motor load to simulate future growth. Use average VFD sizes and average branch circuit lengths.

e) All loads assumed to operate at full load or worst case harmonic load.
f) Do not include any effects of Surge Protective Devices.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Provide overcurrent protective devices in switchboards, panelboards and motor control centers as indicated in those sections.

B. Provide individually enclosed overcurrent protective devices:
   1. Wall mounted:
      a. Finished areas: Attach to studs via unistrut cross members or metal backing bolted or welded to studs where not otherwise shown.
      b. Masonry or concrete walls: Attach to wall via unistrut cross members where not otherwise shown.
      c. Mounting height shall be as indicated on symbol legend or elsewhere in this specification but bottom of enclosure shall not be less than 12 IN AFF.
   2. Where floor mounted provide pad per specification 16010.

C. Field settings:
   1. Perform field adjustments of protective devices as required to place equipment in final operating condition. Settings shall be in accordance with approved power system study.
   2. Provide certified calibration report for each protective device.

D. Arc flash labels:
   1. Provide Arc flash hazard warning label on each piece of electrical equipment.

E. Arc flash boundaries:
   1. Identify arc flash protection boundaries in front of all electrical switchboards, switchgear, panel boards, motor control centers, UPS distribution panels, automatic transfer switches and individual disconnects and circuit breakers. Provide outline of arc flash protection boundaries with 2 IN wide strip of red/white Seton M6356 OSHA warning tape or equivalent.

F. Harmonic field testing:
   1. Perform field testing and record results at each point of common couple and compare test results with preliminary harmonic analysis and specified criteria.
      a. Perform test with building as loaded as possible. Record demand loads.
      b. Measure distortion for harmonics 1 through 49. Calculate total harmonic distortion.

END OF SECTION

SECTION 26 28 16
ENCLOSED SAFETY SWITCHES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish labor, materials, tools, equipment, and services for Enclosed Safety Switches, as indicated, in accordance with provisions of Contract Documents.

B. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. Provide fuses in fusible-type devices by same manufacturer.

1.3 SUBMITTALS

A. Product Data:
   1. Technical data on each type of disconnect switch.

B. Contract Closeout Information:
   1. Operating and maintenance data.
      a. See Section 01 78 23.

1.4 EXTRA MATERIAL

A. Extra Fuses:
   1. 10 percent or minimum of three (3) of each type and rating of installed fuses.
   2. See Section 01 78 43.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Enclosed Safety Switches:
   1. Base:
      a. Eaton Electrical.
      b. Schneider Electric/Square D.
      c. Siemens.
      d. General Electric.

B. Fuses:
      a. Base:
         1) Bussmann.
         2) Ferraz Shawmut.
         3) Brush Fuses.
         4) Littelfuse.

C. Other manufacturers desiring approval comply with Section 00 26 00.

2.2 SAFETY SWITCHES

A. Safety Switches:
   1. Fusible and non-fusible type, NEMA Type HD Heavy Duty construction, unless otherwise indicated.
   2. Enclosure: NEMA 1 unless otherwise indicated.

3. Provide weatherproof disconnect switches as required by Section 26 00 10.
4. Switch blades fully visible in OFF position with door open.
5. Contact operation quick-make and quick-break.
6. Switches for motor circuits to be horsepower rated.
7. Switches for motor circuits controlled by Variable Frequency Drives (VFD) shall include one N.O. and one N.C. contact which operate with the initial movements of the switch and prior to the opening of the main switch.
8. Provide padlocking provisions, with a minimum capacity of 2 padlocks, in OFF position.
9. Finish: Baked enamel over rust-inhibiting primer.
10. Fuses for fusible switches: See Section 26 28 00.
11. Switches shall have interlock with cover in closed position.

B. Fuses
1. UL Class RK-5 fuses: Dual-element time-delay and current-limiting rejection types fuses; UL Class RK-5 listed for 200,000 rms AIC symmetrical, 0-600A; Bussmann "Fusetron", 250 V FRN-RK and 600 V FRS-RK.
2. Use for motor feeder and branch circuit devices where fuses are indicated.

C. UL Class RK-1 dual-element fuses: Dual-element time-delay and current-limiting rejection type fuses; UL Class RK-1 listed for 200,000 rms AIC symmetrical, 0-600 A; Bussmann "Low-Peak", 250 V LPN-RK and 600 V LPS-RK.
1. Use for main feeder devices 600A and smaller where fuses are indicated.

D. UL Class RK-1 single-element fuses: Fast-acting current-limiting rejection type fuses; UL Class RK-1 listed for 200,000 rms AIC symmetrical, 1/10-600A; Bussmann "Limitron", 250 V KTN-RK and 600 V KTS-RK.
1. Use as indicated.

E. UL Class L fuses: Dual-element time-delay and current-limiting type fuses; UL Class L listed for 200,000 rms AIC symmetrical; Bussmann "Low-Peak" 600 V, 601-6000A, Type KRP-C.
1. Use for main and main feeder devices over 600A, where fuses are indicated.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install as indicated and in accordance with manufacturers instructions and recommendations.

B. Switches for motor circuits controlled by VFD's shall be electrically interlocked to the controlling VFD via contacts provided in switch.

C. Provide labeling per Section 26 00 10.

END OF SECTION

SECTION 26 51 13
BUILDING LIGHTING

PART 1 - GENERAL

1.1 SUMMARY

A. Interior luminaires and accessories.

B. Lamps, ballasts and drivers.

1.2 QUALITY ASSURANCE

A. Standards:
   1. Use luminaires conforming to UL Standards, bearing UL labels, and tested by a nationally recognized testing facility under UL1598 and UL 8750, and manufactured in accordance with the NEC.
   2. All lamps and ballasts shall comply with U.S. Federal Efficiency laws.

1.3 SUBMITTALS

A. Shop drawings:
   1. For continuous pattern luminaires, indicate layout, individual section lengths, and lamp quantities. Show details of connections, corners and extensions, end plates, and mounting. Include pendant or bracket locations and show remote transformers and ballast.
   2. Details of special construction, accessories, and/or finishes.

B. Product data:
   1. Lighting:
      a. Identify luminaires by Lighting Equipment Schedule designation. For each luminaire, provide the following:
         1) Name of manufacturer, cutsheet, catalog number and photometric data. Photometric data submitted shall be collected by an independent testing laboratory. Indicate optical performance developed using methods of the Illuminating Engineering Society of North America (IESNA) as follows:
            a) Coefficients of utilization.
            b) Candlepower data presented graphically and numerically, in 10 degree (or smaller) increments. Develop data for up and down quadrants normal, parallel, and at 45 degree to lamp if light output is asymmetric.
            c) Zonal lumens stated numerically in 10 degree increments as above.
         2) Lamp catalog cutsheet clearly indicating manufacturer, lamp selection, lamp length, lamp wattage, lumen output, color temperature, Color Rendering Index (CRI), lamp life, base configuration, and where applicable, Toxicity Characteristic Leaching Procedure (TCLP) compliance and beam angle.
         3) LED luminaire:
            a) Driver catalog cutsheet clearly indicating manufacturer, driver selection, power factor, input wattage, voltage, THD, surge protection, lumen management, and where applicable, dimming range.

C. Samples:
   1. Finishes: Only when specifically requested, submit 4 IN x 6 IN samples of each type of finish specified, on metal to be used.
   2. Luminaires: Only when specifically requested; following shop drawings, product data, and finishes; deliver one sample luminaire of each type requested to A/E's office:
      a. Samples shall be complete with lamps, ballasts, cords and other accessories, ready for operation.

b. After review and approval, transfer sample luminaires from A/E's office to job site for comparison with luminaires delivered for installation. Approved unblemished samples may be used in the work.

D. Project Information:
1. Manufacturer's installation instructions.

E. Contract closeout information:
1. Warrant LED drivers for five years from Date of Substantial Completion. Include labor allowance for full cost of ballast/transformer/driver installation.
2. Warrant the luminaire and all of its components (except the ballast/transformer/driver) to be free from defect in operation or finish for five years from the date of Date of Substantial Completion. As long as the luminaire has been operated within the rated voltage range, the Contractor is responsible for the cost of the materials and labor necessary to repair or replace the luminaire.
3. Inventory of lamp and ballast replacement stocks.
4. It is the responsibility of the contractor to manage all warranty issues that may arise.

F. Review of shop drawings and product data does not waive the Contractor of their obligations.

PART 2 - PRODUCTS

2.1 LUMINAIRES - GENERAL

A. Acceptable manufacturers:
1. Luminaires:
a. Base:
1) As indicated on Lighting Equipment Schedule.
b. Optional:
1) As indicated on Lighting Equipment Schedule.
c. Use catalog numbers listed as a guide only. Follow modifications and other requirements shown or specified.
2. Lamps:
a. Base:
1) GE Lighting.
2) Osram Sylvania.
3) Philips Lighting Company.
4) Cree. (LED only)
5) Xicato. (LED only)
6) Soraa (LED only)
3. The unit price for every piece of lighting equipment shall be provided along with the bid.
4. It is the responsibility of the Contractor to allow adequate time for the review and ordering process of all products. Substitutions will not be accepted on the basis that arrival of the specified luminaires will delay the Contractor’s timeline.

B. Coordinate luminaires with ceiling construction. Advise A/E of discrepancies between luminaire catalog references shown or specified and actual ceiling construction, prior to submission of shop drawings. Failure to do so will require correction at no additional cost.

C. Coordinate ballasts used with lamping, lamp sockets, and control devices prior to submitting shop drawings.

2.2 LUMINAIRE CONSTRUCTION

A. Make luminaire materials resistant to corrosion and thermal and mechanical stresses encountered in normal application. Provide accessory equipment such as starters, sockets and lampholders, approved by UL and ETL, unless otherwise noted.

B. Electrical components of recessed luminaires shall be accessible and removable through luminaire without having to remove luminaire from ceiling.

C. Housings:
   1. Fluorescent luminaires: Minimum 22 gauge sheet steel; integral end plates and trim flanges to suit ceiling construction. Provide wire way covers with captive retainers to allow access to electrical components without use of tools.
   2. Extruded aluminum housings, where scheduled, shall be at least 1/8 inch thick.
   3. Punch and form housings prior to finishing (post-paint).

D. Trim: For square and rectangular luminaires, miter and continuously weld corners. Miter perimeter inverted T-Bar angles at corners. Do not butt or overlap squared ends. Finish joints smooth.

E. Castings: Uniform quality, free from imperfections affecting strength and appearance. Exterior surfaces, if not receiving a finish coat, shall be smooth and match adjacent surfaces. At least one coat of clear methacrylate lacquer shall be applied unless a painted finish is specified.

F. Fasteners: For aluminum or steel luminaires, the fastening hardware shall be cadmium-plated or an equivalent. For stainless steel luminaires stainless steel fasteners shall be used. For bronze luminaires, the fastening hardware shall be bronze or stainless steel.

G. Finishes: As selected from manufacturer's standards unless scheduled otherwise.
   1. Painted surfaces, except as scheduled otherwise:
      a. Manufacturer's standard metal pretreatment and baked or air-dried, light-stabilized enamel finish; acrylic, alkyd, epoxy, polyester or polyurethane.
      b. White finishes shall have minimum 85% reflectance.
   2. Unpainted Aluminum Surfaces:
      a. Interior Luminaires: Clear anodic coating, satin finish, except as scheduled otherwise.
      b. Exterior Luminaires: Clear anodic coating.

H. Lens/Louver Frames: Extruded aluminum with mitered corners unless scheduled otherwise. Hinging or other normal motion shall not cause lens or louver to drop out.

I. Lenses:
   1. The lenses shall be held securely in place but must also be removable to clean and service the luminaire.
      a. Luminaires with a spread lens shall also include a lens orientation device to ensure that it is not affected during cleaning or relamping.
   2. There shall be no light leaks between the lens and the luminaire.

J. Reflectors:
   1. High-purity #12 aluminum reflector sheet, 0.047 inch (15 GA) or heavier if specified, free from fabrication or assembly damages. No exposed rivets, springs or other hardware after installation. Shape reflectors in modified elliptical or parabolic contour to produce no apparent brightness.
   2. Reflector and Baffle Finish: First-quality "Alzak" anodized finish, of specular color as specified.
   3. The reflectors shall be securely fastened but also removable for cleaning and relamping.

K. Gaskets: Provide gaskets at face plates or frames of recessed luminaires which serve as ceiling trim and which allow interior access. Provide moisture seal gaskets at exterior locations and in other areas designated. Secure frames to luminaire bodies with screws or other means, to result in tight installation, without light leaks. See schedules for other types of seals and gaskets.

L. Ventilation: Provide ventilation openings of adequate size and quantity to permit operation of lamps and ballast without affecting rated output or life expectancy.

M. Wiring:
   1. The luminaire shall be factory-wired to be compatible with the project electrical and controls systems.

2. Ballasted luminaires shall comply with NEC requirements and be supplied with a disconnecting means accessible to qualified persons before servicing or maintaining the ballast.

N. Mounting Accessories:
1. Provide appropriate mounting accessories for each luminaire, compatible with various structural conditions encountered. Provide fastening clips (earthquake clips) for luminaires supported from framing members of suspended ceilings.
2. All luminaires with adjustable beam angles shall have a locking device to ensure that the beam distribution is not effected during relamping or cleaning.
3. Recessed Luminaires:
   a. Plaster Frames: Provide frames for luminaires installed in gypsum board and concealed suspension system ceiling tile. Make frames of non-ferrous metal or suitably rustproof after fabrication.
   b. Baffles and Gaskets: As required to prevent light leakage.
   c. Flanged luminaires are required in all ceiling systems except exposed grid lay-in panel type.
4. Luminaire Suspension Material:
   a. Unfinished Spaces: 1/2 inch minimum diameter pendant, unless otherwise noted.
   b. Finished Spaces: Unless otherwise noted, provide manufactured cable or stem and outlet box canopy; contemporary design with swivel self-aligning features; size canopy to cover outlet box; finished to match luminaire. Coordinate pendant location with ceiling tiles/ceiling grid, and submit coordinated mounting accessories as part of shop drawing submission. For high intensity discharge lamps, use stems suspended from swivel shock-absorbing fittings.

2.3 LAMPS

A. LED's:
1. Color temperature specified shall be uniform for all LED modules within like luminaire types. Color temperature measurement shall have a maximum 2 SDCM on the MacAdam Ellipse.
2. Correlated color temperature of 3500 ºK.
3. Minimum color rendering index (CRI) of 85.
4. LED light output and efficacy shall be measured in accordance with IES LM-79 standards.
5. LED life and lumen maintenance shall be measured in accordance with IES LM-80 standards.
   a. Rated minimum life of 50,000 hours.
6. The individual LED's shall be connected such that a catastrophic loss or the failure of one LED will not result in a light output loss of the entire luminaire.

2.4 BALLASTS

A. LED Drivers
1. Driver shall operate from 60 Hz input source of 120V through 277V with sustained variations of +/- 10 percent (voltage and frequency).
2. Driver input current shall have Total Harmonic Distortion (THD) of less than 20 percent when operated at nominal line voltage.
3. Driver shall have a Power Factor greater than 0.90.
4. Driver shall avoid interference with infrared devices and eliminate visible flicker.
5. Driver shall comply with ANSI C62.41 Category A for Transient protection.
6. Driver shall comply with the requirements of the Federal Communications Commission (FCC) rules and regulations, Title 47 CFR part 18, Non-Consumer (Class A) for EMI/RFI (conducted and radiated).
7. The luminaire shall be capable of continuous dimming over a range of 100% to 5% of rated lumen output. Dimming shall be controlled by a 0-10VDC signal.
8. Control device must be compatible with type of driver, and coordinated prior to submission of shop drawings.

9. If driver is remote-mounted, provide maximum allowable distances for secondary wire runs to luminaires.
10. Provide with mounting hardware as required.

PART 3 - EXECUTION

3.1 COORDINATION

A. Coordinate luminaire mounting and trim type with architectural reflected ceiling plans and/or room finish schedules prior to submission of shop drawings. Advise Lighting Designer of any discrepancies. Failure to do so will result in correction at no additional cost to Owner.

B. Coordinate required above-ceiling clearances of recessed luminaires with ductwork and piping. In exposed ceiling areas, coordinate luminaire locations, mounting heights, and supports with other trades.

3.2 INSTALLATION

A. Strictly follow the manufacturer's directions for installation of all lighting equipment. Assemble and wire luminaires, with lamps, in such a manner to ensure correct operation.

B. Locate luminaires in accordance with architectural reflected ceiling plans.
   1. Where luminaires are installed in acoustical tile ceilings, locate in exact center of tile unless indicated otherwise. Relocate misplaced luminaires and replace damaged ceiling materials.

C. Mount luminaires at heights indicated in Section 26 00 10 and as indicated on drawings.

D. The Contractor is responsible for checking that the structural support is adequate to ensure that all luminaires are properly supported to keep them level and in alignment.

E. Provide hangers with enclosure rating (NEMA 1, 4, or 7) equal to enclosure requirements of area in which they are installed.

F. Luminaires shall be grounded as required in NEC Article 410.

G. At all exit signs, provide the directional arrows (chevrons) as required for proper exiting.

H. Recessed Luminaires:
   1. Note that specifications for recessed luminaires generally do not include mounting accessories, and that each luminaire type may be used in several different ceiling types. Verify mounting details for each space; provide correct luminaire flange mounting accessories for each condition.
   2. Fasten luminaires supported by suspended ceiling systems to ceiling framing system with hold-down clips and to building structure with two No. 12 gauge steel hanger wires connected to opposite corners of the luminaire. Each hanger shall have the capacity of 100 percent of luminaire weight acting in any direction.
   3. Support downlights and exit signs with rails spanning between runners of suspension system.
   4. Support troffers in gypsum board ceilings from plaster frames, with adjustable lugs on side of luminaire or yoke mounting as recommended by luminaire manufacturer.
   5. Support downlights in metal pan and gypsum board ceilings from plaster frames.
   6. Provide access panels for recessed luminaires that require access for maintenance when such access is not provided for in design of luminaire. See Section 26 00 10.
   7. Orientate the horizontally-positioned fluorescent lamps or LED circuit boards of all 2 FT x 2 FT within a single room in the same direction.
   8. Wherever recessed luminaires are installed in insulated ceiling systems, it is the responsibility of the Contractor to construct above-ceiling enclosures around non-insulation-contact-rated equipment to provide at least 3 inches or airspace on each side of the luminaire.

I. Surface-Mounted and Pendant-Hung Luminaires:

1. Attach surface-mounted lighting luminaires to ceiling system with positive clamping devices that completely surround supporting members. Attach safety wires between clamping device and adjacent ceiling hanger or to structure above. In no case shall luminaire load exceed design carrying capacity of supporting member.
2. Support pendant-hung lighting luminaires directly from structure above, using 9 gauge steel wire, without relying on ceiling suspension system for support.
3. Pierce ceiling material for hangers and outlet boxes as required.
4. Do not remove ceiling material above surface mounted luminaires.
5. Hang luminaires plumb with continuous rows in alignment.
6. Unless otherwise noted, suspend luminaires in each room or area at the same height regardless of varying clear height conditions. Provide various stem lengths as required.
7. Provide pendant cylinder luminaires with swivel hangers which will allow luminaire to swing in any direction but will not permit stem to rotate.
8. In mechanical, electrical and storage spaces, pendant-mounted, open industrial luminaires, not in continuous rows, shall be supported either (a) by conduit or (b) by metal channel , similar to Unistrut, and all-thread. Pendant-mounted luminaires in continuous rows shall be fastened to each other or mounted on continuous metal channel. Provide reflector alignment clips on all industrial luminaires mounted in continuous rows.

J. Continuous Luminaire Patterns:
1. Fasten sections together for continuously aligned appearance, with no dimpling or light leakage. Provide end extensions where required.
2. Where luminaires run continuously around inside or outside corners, provide prefabricated corner pieces. Run luminaire lenses, baffles or louvers continuously with luminaire. Miter and/or fan at corners as directed. Where lenses are used, the maximum visible gap between the edge of lens and the end of luminaire trim is 1/16 inch.
3. Only where continuous runs do not end at a wall or fascia, provide a finished end plate, with no visible holes and concealed fasteners.
4. Provide a continuous light appearance over total length of assembly. The total light length shall equal total continuous length minus 6 inches maximum. The maximum permitted non-lamped length at either end shall not exceed 3 inches.
   a. For fluorescent fixtures, utilize 3 and 4 foot linear lamps wherever possible. Where required, provide a 2 foot lamp in spaces less then 3 feet in length.
5. Cove luminaires in architectural coves shall be installed continuously with no gaps between the luminaires.

3.3 ADJUSTABLE FIXTURES

A. Aim adjustable fixtures as directed. Make all final adjustments in presence of the Lighting Designer. In general, perform this work at night with no light from stray sources. Use light meter to obtain as even a distribution as possible.

B. Aiming shall occur upon substantial completion of project including, but not limited to, installation of all artwork, millwork, furniture, and plantings. Contractor shall provide all necessary ladders, scaffolding, or lifts required for accessing fixtures, and shall coordinate this activity based on the on-site availability of the Lighting Designer.

3.4 RELAMPING AND CLEANING

A. Replace all inoperable lamps with new lamps prior to final acceptance.

B. Replace all noisy and malfunctioning ballasts and/or drivers prior to final acceptance.

C. Align luminaires and remove all paint splatters, dirt and debris. Touch up any visible damages to luminaire finish.

D. Wipe clean all luminaire reflectors, lenses, lamps and trims, after installation. All luminaires shall be installed with caution so as to avoid any fingerprints or smudges on surfaces of parabolic louvers and downlight reflectors. Use cleaning materials and methods that will not damage finish. Wherever fingerprints or smudges cannot be adequately removed, the affected luminaire(s) shall be replaced.

E. All cove luminaires in an architectural cove shall be installed after cove has been painted. All construction debris shall be vacuumed out of the cove to ensure a dust-free reflector surface prior to Date of Substantial Completion.

3.5 SPECIAL PROTECTION

A. Wherever fixtures are provided with protective covers suitable for use after installation, leave such covers in place throughout construction period, and remove immediately prior to Date of Substantial Completion.

3.6 REPLACEMENT STOCK

A. The Contractor shall provide the Owner's initial lamp replacement stock sufficient to re-lamp 2% of the luminaires, but no fewer than 2 luminaires and no more than 24 luminaires of all luminaire types using the same, identical LEDs unless LEDs are an irreplaceable and inherent/integral part of the entire luminaire in which case no spares are requested unless otherwise indicated in the Lighting Equipment Schedule.
   1. Lamps that fail within 90 days of the Date of Substantial Completion must be replaced by the Contractor with no charge to the Owner. These replacement lamps are not to be taken from the Owner's initial replacement stock.

B. The Contractor shall also provide the Owner's ballast/driver/transformer replacement stock. This stock will consist of 2% of each ballast/ driver/transformer type but not fewer than 5 or more than 30 of any one type. All ballasts/drivers/transformers shall match exactly the types specified and provided for installed luminaires on this project. The warranty replacements are not be taken from this stock.

END OF SECTION

DIVISION 27

COMMUNICATIONS

SECTION 27 05 30
EMPTY CONDUIT AND OUTLET BOXES

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Empty Conduit and Outlet Boxes, as indicated, in accordance with provisions of Contract Documents.

B. Work in this section is for following systems:
   1. Telephone and Data Drops
   2. TV Antenna locations (as directed by the Owner)
   3. AV system connections as shown on the drawings.
   4. Security: Coordinate with Division 28 and "DE" series sheets.
   5. Public address speaker system.

C. Completely coordinate with work of other trades.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Conduit: As specified in Section 26 05 33.

B. Conduit stub-outs: From outlet box to 6 IN above nearest lay-in type corridor ceiling, terminated with insulated bushing.
   1. Provide pulling wire or heavy nylon pulling cord for conduit more than 25 FT long.
   2. TV antenna stub-outs: 1/2 IN.
   3. Telephone and Data stub-outs: 1-1/4 IN.

C. Outlet box - General: With extension ring, of proper size and depth, with cover plate to match wiring device cover.

D. TV antenna outlet boxes: Standard flush switch box.
   1. Coordinate requirements and location with Owner.

E. Data processing terminal outlet boxes: 4-11/16 x 4-11/16 x 2-1/8 IN box with blank plate.

F. Telephone backboards:
   2. 3/4 x 48 x 48 IN, fire retardant treated plywood, rough side against wall.
   3. Paint with two coats of white or similar light color paint prior to installation of terminal blocks or equipment.
   4. Do not paint over the fire rating seal on the plywood. Contractor shall replace plywood if the rating seal is not visible for inspection.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Install all components as indicated and per Owner's Standards.

B. Tag ends of conduit with system identification letters.

C. Test conduit for clear passage.

D. Mark inside of outlet boxes with system identification letters using black felt-ink mark.

END OF SECTION

SECTION 27 05 32
WIRED TELECOMMUNICATION SYSTEMS

PART 1 - GENERAL

1.1 SUMMARY

A. Furnish all labor, materials, tools, equipment, and services for Wired Telecommunication Systems, as indicated, in accordance with provisions of Contract Documents.

B. Work in this section is for following systems:
   1. Telephone.
   2. Data.

C. Completely coordinate with work of other trades.

1.2 QUALITY ASSURANCE

A. All equipment and wiring for data processing and telephone shall meet IBM standards for data transmission or Bell system standards for voice transmission respectively.

1.3 SUBMITTALS

A. Shop Drawings:
   1. Telecommunication systems:
      a. Wiring diagrams and riser diagram.
      b. Equipment design considerations for future expansion, when indicated.

B. Product Data:
   1. Technical data on all components.
   2. Materials list and backbox schedule (including unique backboxes).

C. Contract Closeout Information:
   1. Operating and maintenance data.
      a. Factory-prepared operation and service manual for each system.
      b. Include operation details, schematics, wiring diagrams, color codings, terminal numbers and component values for printed-circuit boards.
   2. Owner instruction report.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Jacks:
   1. Base:
      a. Match existing and relocate existing if possible.

B. Wire and cable:
   1. Base:
      a. Match existing and reuse existing.

2.2 WIRED TELECOMMUNICATIONS SYSTEMS

A. Description:
   1. Telephone:
   2. Data processing:

2.3 MATERIALS

A. Conduit: As specified in Section 26 05 33.

B. Outlet requirements:
   1. Telephone:
      a. Match existing and Owner's IT standards.
   2. Data:
      a. Match existing and Owner's IT standards.

C. Outlet box requirements:
   1. See Section 270530.

D. Cable requirements from outlet to terminal point:
   1. Telephone:
      a. Match Existing.
   2. Data:
      a. Provide Three CAT 6 cables to each drop unless otherwise noted.

E. Conduit requirements:
   1. See Section 270530.

F. Remote terminal requirements:
   1. Telephone: 110 blocks sufficient to terminate all cables and 25 percent spare. Provide stand-off brackets.
   2. Data processing: 110 blocks sufficient to terminate all cables and 25 percent spare. Provide stand-off brackets.
   3. Mount telephone and data terminals on plywood backboard.

G. Telephone backboards:
   2. 3/4 x 48 x 48 IN, fire retardant treated plywood rough side against wall.
   3. Paint with two coats of white or similar light color paint prior to installation of terminal blocks or equipment.
   4. Do not paint over the fire rating seal on the plywood. Contractor shall replace plywood if the rating seal is not visible for inspection.

H. Main terminal requirements:
   1. Telephone: 110 blocks sufficient to terminate all cables and 25 percent spare. Provide stand-off brackets.
   2. Mount telephone and data terminals on plywood backboard.

I. Telephone cable:
   1. Shall match existing.

J. Data cable:
   1. Reuse as much as possible per Owner's direction.
   2. New shall match existing.

K. Riser cables:
   1. Provide, install and terminate riser cables from main distribution point to remote terminals.
   2. Telephone and data riser cables shall be multiple pair cables meeting telephone cable specification above.
      a. Each riser shall include adequate conductors to fully wire all outlets served and 25 percent spare capacity.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Mark inside of outlet boxes with system identification letters using black felt-ink mark.

B. Clearances: Maintain clearance to at least one side of cable trays and enclosed wireways to permit future cable installation. Maintain a minimum of 9 IN headroom above cable tray side rail and top of wireway on side with clearance. Ductwork and piping that obstruct clearances for limited distances are acceptable when routed at right angles to tray or wireway.

C. Cable slack: Leave 6 IN slack protruding from wall at outlet mounting point and protect from damage by workmen prior to installing outlet.

D. Labeling: Provide cable and system component labels. No two cables shall have same cable number.

E. Cable pulling and termination:
   1. Do not exceed cable pulling force and minimum cable bending radius.
   2. Cable terminations at distribution racks for voice and data to be done in a neat and workmanlike manner.
   3. Tie-wrap cables and cut to length at termination points.
   4. All cables shall be pulled by Contractor in continuous splice-free runs unless otherwise indicated on drawings or specified.

F. Telephone and data cable organization:
   1. All station cables shall be pulled in and terminated on 110 blocks as indicated below:
      a. Note: Order of pairs punched-down to 110 block:
         1) 1 - White/Blue.
         2) 2 - Blue/White.
         3) 3 - White/Orange.
         4) 4 - Orange/White.
         5) 5 - White/Green.
         6) 6 - Green/White.
         7) 7 - White/Brown.
         8) 8 - Brown/White.
   2. All riser cables shall be pulled in and terminated on telephone terminal blocks as indicated below:

PAIR	COLOR	PAIR	COLOR
1	Bl/W - W/Bl	14	Br/Bk - Bk/Br
2	O/W - W/O	15	S/Bk - Bk/S
3	G/W - W/G	16	Bl/Y - Y/Bl
4	Br/W - W/Br	17	O/Y - Y/O
5	S/W - W/S	18	G/Y - Y/G
6	Bl/R - R/Bl	19	Br/Y - Y/Br
7	O/R - R/O	20	S/Y - Y/S
8	G/R - R/G	21	Bl/V - V/Bl
9	Br/R - R/Br	22	O/V - V/O
10	S/R - R/S	23	G/V - V/G
11	Bl/Bk - Bk/Bl	24	Br/V - V/Br
12	O/Bk - Bk/O	25	S/V - V/S
13	G/Bk - Bk/G		

   3. Coordinate station cable termination to jacks with Owner.

G. Cable testing:
   1. Per Owner’s IT standards.

H. Cabling documentation:
   1. Each terminal block in main distribution room shall have a unique identification.
   2. Terminal block identification shall be repeated at appropriate remote terminal.

3. Provide to Owner at job completion schedules identifying each conductor from outlet jack to main terminal room blocks.

END OF SECTION