FAYETTE County
Create Your Story!

Purchasing Department
140 Stonewall Avenue West, Ste 204
Fayetteville, GA 30214
Phone: 770-305-5420
www.fayettecountyga.gov

May 8, 2025

Subject: Invitation to Bid #2584-B: Justice Center Buildout - Construction

Gentlemen/Ladies:

Fayette County, Georgia invites you to submit a bid for the renovation of the Fayette County Justice Center. You are invited to submit a bid in accordance with the information contained herein.

A mandatory pre-bid conference will be held on 10:00a.m., Thursday, June 5, 2025, at Fayette County Justice Center to provide an opportunity for you to become more familiar with the project, and to ask questions. Companies that attend will be invited to submit bids.

Questions concerning this invitation to bid should be addressed to Sherry White, Senior Contract Administrator in writing via email to swhite@fayettecountyga.gov or fax to (770) 305-5314. Questions will be accepted until 2:00p.m., Tuesday, June 10, 2025.

Purchasing Department office hours are Monday through Friday 8:00 a.m. to 5:00 p.m. The office telephone number is (770) 305-5420.

Please return your response to the following address:

Fayette County Purchasing Department
140 Stonewall Avenue West, Suite 204
Fayetteville, Georgia 30214

Bid Number: 2584-B
Bid Name: Justice Center Buildout - Construction

Your envelope *must* be sealed, and should show your company's name and address.

Bids will be received at the above address until 3:00p.m., Tuesday, June 17, 2025, in the Purchasing Department, Suite 204. Bids will be opened at that time.

Bids must be signed to be considered. Late bids cannot be considered. Faxed bids or emailed bids cannot be considered.

If you download this invitation to bid from the county's web site, it will be your responsibility to check the web site for any addenda that might be issued for this solicitation. The county cannot be responsible for a vendor not receiving information provided in any addendum.

Thank you for participating in the solicitation process.

Sincerely,

Ted L. Burgess
Chief Procurement Officer

TLB/sw

Attachment

Invitation to Bid #2584-B: Justice Center Buildout - Construction

GENERAL TERMS AND CONDITIONS

1. **Definitions**:
    a. **Bidder**: A company or individual who submits a bid in response to this Invitation to Bid.
    b. **Successful Bidder**: The company or individual that is awarded a contract.
    c. **Contractor**: The Successful Bidder, upon execution of the contract.
    d. **County**: Fayette County, Georgia.

2. **Bid is Offer to Contract**: Each bid constitutes an offer to become legally bound to a contract with the County, incorporating the invitation to bid and the bidder's bid. The binding offer includes compliance with all terms, conditions, special conditions, specifications, and requirements stated in the invitation to bid, except to the extent that a bidder takes written exception to such provisions, and the County agrees to the exception. All such terms, conditions, special conditions, specifications, and requirements will form the basis of the contract. The bidder should take care to answer all questions and provide all requested information, and to note any exceptions in the bid submission. Failure to observe any of the instructions or conditions in this invitation to bid may result in rejection of the bid.

3. **Binding Offer**: To allow sufficient time for a contract to be awarded, each bid shall constitute a firm offer that is binding for ninety (90) days from the date of the bid opening to the date of award.

4. **Bidder's Questions**: As appropriate, the County will post answers to questions and/or other information concerning the Invitation to Bid in the form of an addendum on the County's website at www.fayettecountyga.gov. It is the responsibility of the prospective bidder to check the website for any addenda issued for this invitation to bid.

5. **References**: Include with your bid a list of three (3) jobs that your company has done that are of the same or similar nature to the work described in this invitation to bid, on the form provided. Include all information as requested on the form.

6. **Bid Submission:** Submit your bid, along with any addenda issued by the County, in a *sealed* opaque envelope. Mail or deliver one (1) original bid, signed in ink by a company official authorized to make a legal and binding offer, and one (1) copy on a flash drive, to:

    Fayette County Government
    Purchasing Department
    140 Stonewall Avenue West, Suite 204

    Fayetteville, GA 30214
    Bid Number: **2584-B**
    Bid Name: **Justice Center Buildout - Construction**

Also show your company name on the envelope. You may submit sealed bids in person, by U.S. mail, or by a commercial carrier. Do not submit bids by facsimile, e-mail, or other electronic means. Once submitted, all bids become the property of Fayette County.

7. **Bid Preparation Costs**: The bidder shall bear all costs associated with preparing the bid.

8. **Late Bids:** Bids not received in the Purchasing Department by the time and date of the scheduled bid opening will not be considered.

9. **More than One Bid**: Do not submit alternate bids or options, unless requested or authorized by the County in the Invitation to Bid. If a responder submits more than one bid without being requested or authorized to do so, the County may disqualify the bids from that responder, at the County's option.

10. **Bid Corrections or Withdrawals:** The bidder may correct a mistake, or withdraw a bid, before the bid opening by sending written notification to the Director of Purchasing. Bids may be withdrawn after the bid opening only with written authorization from the Director of Purchasing.

11. **Defects or Irregularities in Bids:** The County reserves the right to waive any defect or irregularity in any bid received. In case of a discrepancy between unit prices and extended prices, the unit price will govern unless the facts or other considerations indicate another basis for correction of the discrepancy.

12. **Prices Held Firm**: Prices bid shall be firm for the period of the contract, unless otherwise specified in the contract. All prices bid for commodities, supplies, equipment, or other products shall be quoted FOB Destination, Fayette County or job site.

13. **Brand Name:** If items in this invitation for bid have been identified, described or referenced by a brand name or trade name description, such identification is intended to be descriptive, but not restrictive and is to indicate the quality and characteristics of products that may be offered. Alternative products may be considered for award if clearly identified in the bid. Items offered must meet required specifications and must be of a quality which will adequately serve the use and purpose for which intended.

14. **Bidder Substitutions:** Bidders offering substitutions or deviations from specifications stated in the invitation to bid, shall list such substitutions or deviations on the "Exceptions to Specifications" sheet provided, or on a separate sheet to be submitted with the bid. The absence of such list shall indicate that the bidder has taken no exception to the specifications. The evaluation of bids and the determination as to equality and acceptability of products or services offered shall be at the discretion of the County.

15. **Samples**: When the County requires samples as part of the bid and vendor selection process, bidders must provide requested samples within the time allotted, and at no cost to the County unless otherwise specified. Any goods provided under contract shall conform to the sample submitted. The County will return samples only at the bidder's request, and at the bidder's expense, if they are not destroyed by testing.

16. **Non-Collusion**: By responding to this Invitation to Bid, the bidder represents that the bid is not made in connection with any competing bidder, supplier, or service provider submitting a separate response to this invitation to bid, and is in all respects fair and without collusion or fraud.

17. **Bid Evaluation:** Award will be made to the lowest responsive, responsible bidder, taking into consideration payment terms, vendor qualifications and experience, quality, references, any exceptions listed, and/or other factors deemed relevant in making the award. The County may make such investigation as it deems necessary to determine the ability of the bidder to perform, and the bidder shall furnish to the County all information and data for this purpose as the County may request. The County reserves the right to reject any bid item, any bid, or all bids, and to re-advertise for bids.

18. **Award of Base Bid and Alternates**: Award of a contract for this project will be made on the Base Bid and any Alternates chosen by the County.

19. **Unbalanced Bid**: If the County determines that the apparent low bid is unbalanced, the County retains the right to negotiate with the apparent low bidder for the purpose of correcting the bid imbalance without changing the overall bid amount. If the apparent low bidder and the County cannot reach agreement, the County may deem the apparent low bid non-responsive. In such case, the County reserves the right to award to the next-lowest bidder, or to reject any and all bids and re-advertise the project.

20. **Payment Terms and Discounts**: The County's standard payment terms are Net 30. Any deviation from standard payment terms must be specified in the resulting contract, and both parties must agree on such deviation. Cash discounts offered will be a consideration in awarding the bid, but only if they give the County at least 15 days from receipt of invoice to pay. For taking discounts, time will be computed from the date of invoice acceptance by the County, or the date a correct invoice is received, whichever is the later date. Payment is deemed made, for the purpose of earning the discount, on the date of the check.

21. **Trade Secrets – Confidentiality:** If any person or entity submits a bid or proposal that contains trade secrets, an affidavit shall be included with the bid or proposal. The affidavit shall declare the specific included information which constitutes trade secrets. Any trade secrets must be either (1) placed in a separate envelope, clearly identified and marked as such, or (2) at a minimum, marked in the affidavit or an attached document explaining exactly where such information is, and otherwise marked, highlighted, or made plainly visible. See O.C.G.A. § 50-18-72 (A)(34).

22. **Trade Secrets – Internal Use:** In submitting a bid, the bidder agrees that the County may reveal any trade secret materials contained in the bid to all County staff and officials involved in the selection process, and to any outside consultant or other third parties who may assist in the selection process. The bidder agrees to hold harmless the County and each of its officers, employees, and agents from all costs, damages, and expenses incurred in connection with refusing to disclose any material which the bidder has designated as a trade secret.

23. **Ethics – Disclosure of Relationships**: Before a proposed contract in excess of $10,000.00 is recommended for award to the Board of Commissioners or the County Administrator, or before

the County renews, extends, or otherwise modifies a contract after it has been awarded, the Contractor must disclose certain relationships with any County Commissioner or County Official, or their spouse, mother, father, grandparent, brother, sister, son or daughter related by blood, adoption, or marriage (including in-laws). A relationship that must be reported exists if any of these individuals is a director, officer, partner, or employee, or has a substantial financial interest the business, as described in Fayette County Ordinance Chapter 2, Article IV, Division 3 (Code of Ethics).

If such relationship exists between your company and any individual mentioned above, relevant information must be presented in the form of a written letter to the Director of Purchasing. You must include the letter with any bid, proposal, or price quote you submit to the Purchasing Department.

In the event that a Contractor fails to comply with this requirement, the County will take action as appropriate to the situation, which may include actions up to and including rejection of the bid or offer, cancellation of the contract in question, or debarment or suspension from award of a County contract for a period of up to three years.

24. **Contract Execution & Notice to Proceed**: After the Board of Commissioners makes an award, all required documents are received by the County, and the contract is fully executed with signature of both parties, the County will issue a written Notice to Proceed. The County shall not be liable for payment of any work done or any costs incurred by any bidder prior to the County issuing the Notice to Proceed.

25. **Unavailability of Funds**: This contract will terminate immediately and absolutely at such time as appropriated and otherwise unobligated funds are no longer available to satisfy the obligations of the County under the contract.

26. **Insurance**: The Successful Bidder shall procure and maintain the following insurance, to be in effect throughout the term of the contract, in at least the amounts and limits as follows:

    a. **General Liability Insurance**: $1,000,000 combined single limit per occurrence, including bodily and personal injury, destruction of property, and contractual liability.

    b. **Automobile Liability Insurance**: $1,000,000 combined single limit each occurrence, including bodily injury and property damage liability.

    c. **Worker's Compensation & Employer's Liability Insurance**: Workers Compensation as required by Georgia statute.

    ~~d.~~ **Builder's "All Risk" Insurance**: In the event the Contractor is performing construction services under the contract, Contractor shall procure and maintain "all-risk" builder's insurance, providing coverage for the work performed under the contract, and the materials, equipment or other items incorporated therein, while the same are located at the construction site, stored off-site, or at the place of manufacture. The policy limit shall be at least 100% of the value of the

contract, including any additional costs which are normally insured under such policy.

e. **Other Coverage:** and all other coverages as specified in the General Conditions, Section #21.

Before a contract with the Successful Bidder is executed, the Successful Bidder shall provide Certificates of Insurance for all required coverage. The Successful Bidder can provide the Certificate of Insurance after award of the contract, but must be provided prior to execution of the contract document by both parties. The certificate shall list an additional insured as follows:

Fayette County, Georgia
140 Stonewall Avenue West
Fayetteville, GA 30214

27. **Bid Bond**: Bidder shall include a bid bond with your bid, equal to five percent (5%) of the total amount bid. Bid bonds shall be provided by a surety which appear son the U.S. Treasury's list of approved bond sureties (Circular 570).

28. **Performance and Payment Bonds**: Prior to execution of a contract, the Successful Bidder shall submit performance and payment bonds each equal to 100 percent of the contract value, provided by a surety which appears on the U.S. Treasury's list of approved bond sureties (Circular 570). *Also see General Conditions, Section #22.*

29. **Building Permits**: Work performed for the County requiring building permits by licensed Contractors will not have permit fees assessed, although any re-inspection fees for disapproved inspections will be the responsibility of the Contractor prior to final inspections and the Certificate of Occupancy or Certificate of Completion being issued.

30. **Unauthorized Performance:** The County will not compensate the Contractor for work performed unless the work is authorized under the contract, as initially executed or as amended.

31. **Assignment of Contract:** See General Conditions, Section #23.

32. **Indemnification**: See General Conditions, Section #24.

33. **Severability**: The invalidity of one or more of the phrases, sentences, clauses or sections contained in the contract shall not affect the validity of the remaining portion of the contract. If any provision of the contract is held to be unenforceable, then both parties shall be relieved of all obligations arising under such provision to the extent that the provision is unenforceable. In such case, the contract shall be deemed amended to the extent necessary to make it enforceable while preserving its intent.

34. **Delivery Failures:** If the Contractor fails to deliver contracted goods or services within the time specified in the contract, or fails to replace rejected items in a timely manner, the County shall

have authority to make open-market purchases of comparable goods or services. The County shall have the right to invoice the Contractor for any excess expenses incurred, or deduct such amount from monies owed the Contractor. Such purchases shall be deducted from contracted quantities.

35. **Substitution of Contracted Items:** The Contractor shall be obligated to deliver products awarded in this contract in accordance with terms and conditions specified herein. If the Contractor is unable to deliver the products under the contract, it shall be the Contractor's responsibility to obtain prior approval of the ordering agency to deliver an acceptable substitute at the same price quoted in the Contractor's original bid. In the event the Contractor consistently needs to substitute or refuses to substitute products, the County reserves the right to terminate the contract or invoke the "Delivery Failures" clause stated herein.

36. **Inspection and Acceptance of Deliveries**: The County reserves the right to inspect all goods and products delivered. The County will decide whether to accept or reject items delivered. The inspection shall be conclusive except with respect to latent defects, fraud, or such gross mistakes as shall amount to fraud. Final inspection resulting in acceptance or rejection of the products will be made as soon as practicable, but failure to inspect shall not be construed as a waiver by the County to claim reimbursement or damages for such products which are later found to be in non-conformance with specifications. Should public necessity demand it, the County reserves the right to use or consume articles delivered which are substandard in quality, subject to an adjustment in price to be determined by the Purchasing Director.

37. **Termination for Cause**: The County may terminate the contract for cause as described in the General Conditions, Section #18.2.

38. **Termination for Convenience**: The County may terminate the contract for its convenience at any time with 10 days' written notice to the Contractor. In the event of termination for convenience, the County will pay the Contractor for services performed. The County will compensate partially completed performance based upon a signed statement of completion submitted by the Contractor, which shall itemize each element of performance completed.

39. **Force Majeure**: Neither party shall be deemed to be in breach of the contract to the extent that performance of its obligations is delayed, restricted, or prevented by reason of any act of God, natural disaster, act of government, or any other act or condition beyond the reasonable control of the party in question.

40. **Governing Law**: This agreement shall be governed in accordance with the laws of the State of Georgia. The parties agree to submit to the jurisdiction in Georgia, and further agree that any cause of action arising under this agreement shall be required to be brought in the appropriate venue in Fayette County, Georgia.

41. **Open Records Act**: In the event that the Contractor receives, and responds to, a request for information as provided in Georgia's Open Records Act (O.C.G.A. § 50-18-70 *et seq.*), the Contractor shall promptly provide the County the same information provided to the initiator of the request for information. Contractor shall email such information to the county's Custodian of Records at tsmith@fayettecountyga.gov.

Fayette County, Georgia

Checklist of Documents to Return

(Please return this checklist and the documents listed below with your submittal)

ITB #2584-B: Justice Center Buildout - Construction

Company Information – *Form Provided* _____

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(1) – *Form Provided* _____

Bid Bond _____

Bid & Bid Schedule – *Form Provided* _____

Exceptions, if any – *Form Provided* _____

References – *Form Provided* _____

Signed addenda, if any are issued _____

COMPANY NAME: _____

COMPANY INFORMATION

ITB #2584-B: Justice Center Buildout

A. COMPANY

Company Name: _____

Physical Address: _____

_____

Mailing Address (if different): _____

_____

Website (if applicable): _____

B. AUTHORIZED REPRESENTATIVE

Signature: _____

Printed or Typed Name: _____

Title: _____

E-mail Address: _____

Phone Number: _____

C. PROJECT CONTACT PERSON

Name: _____

Title: _____

E-mail Address: _____

Phone Number: _____

Contractor Affidavit under O.C.G.A. § 13-10-91(b)(l)

The undersigned contractor ("Contractor") executes this Affidavit to comply with O.C.G.A § 13-10-91 related to any contract to which Contractor is a party that is subject to O.C.G.A. § 13-10-91 and hereby verifies its compliance with O.C.G.A. § 13-10-91, attesting as follows:

a) The Contractor has registered with, is authorized to use and uses the federal work authorization program commonly known as E-Verify, or any subsequent replacement program;

b) The Contractor will continue to use the federal work authorization program throughout the contract period, including any renewal or extension thereof;

c) The Contractor will notify the public employer in the event the Contractor ceases to utilize the federal work authorization program during the contract period, including renewals or extensions thereof;

d) The Contractor understands that ceasing to utilize the federal work authorization program constitutes a material breach of Contract;

e) The Contractor will contract for the performance of services in satisfaction of such contract only with subcontractors who present an affidavit to the Contractor with the information required by O.C.G.A. § 13-10-91(a), (b), and (c);

f) The Contractor acknowledges and agrees that this Affidavit shall be incorporated into any contract(s) subject to the provisions of O.C.G.A. § 13-10- 91 for the project listed below to which Contractor is a party after the date hereof without further action or consent by Contractor; and

g) Contractor acknowledges its responsibility to submit copies of any affidavits, drivers' licenses, and identification cards required pursuant to O.C.G.A. § 13-10-91 to the public employer within five business days of receipt.

_____ _____

Federal Work Authorization User Identification Number Date of Authorization

_____ **2584-B Justice Center Buildout - Construction**

Name of Contractor Name of Project

Fayette County, Georgia

Name of Public Employer

I hereby declare under penalty of perjury that the foregoing is true and correct.

Executed on _____, _____, 20_____ in _____ (city), _____ (state).

_____

Signature of Authorized Officer or Agent

_____

Printed Name and Title of Authorized Officer or Agent

SUBSCRIBED AND SWORN BEFORE ME
ON THIS THE _____ DAY OF _____, 20_____.

_____

NOTARY PUBLIC

My Commission Expires: _____

REFERENCES

ITB #2584-B: Justice Center Buildout - Construction

Please list three (3) references for current or recent customers who can verify the quality of service your company provides. Projects of similar size and scope are preferable.

1. Government/Company Name _____

City & State _____

Work or Service Provided_____

Approximate Completion Date _____

Contact Person and Title _____

Phone _____ Email _____

2. Government/Company Name _____

City & State _____

Work or Service Provided_____

Approximate Completion Date _____

Contact Person and Title _____

Phone _____ Email _____

3. Government/Company Name _____

City & State _____

Work or Service Provided_____

Approximate Completion Date _____

Contact Person and Title _____

Phone _____ Email _____

COMPANY NAME_____

EXCEPTIONS TO SPECIFICATIONS

Invitation to Bid #2584-B: Justice Center Buildout – Construction

Please list below any exceptions or clarifications to the specifications. Explain any exceptions in full.

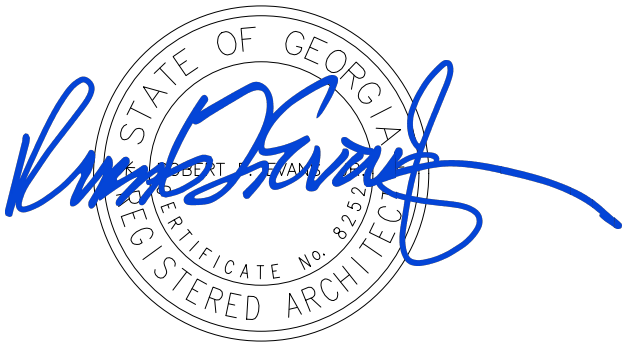
COMPANY NAME: _____

SET NO: _____
IPG PROJECT No. 2312

RFP #2584-B
PROJECT SPECIFICATIONS

Renovation of
Fayette County Justice Center
Fayetteville, GA 30214

Bid Documents



ENGINEERING SERVICES, INC.

CREWS Engineering

NBP ENGINEERS

ARCHITECTS & PLANNERS

TANNER HOSKINS CONSULTANTS, LLC
ELECTRONIC SECURITY SYSTEMS, ELECTRICAL & SECURITY HARDWARE

IPG, INCORPORATED
ARCHITECTS & PLANNERS
807 Northwood Park Drive • Valdosta, Georgia 31602 • (229) 242-3557
mail@ipgarchitects.com http://www.ipgarchitects.com

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SCOPE OF WORK

Background

The Fayette County Justice Center Complex was built in 2003. The 153,000 SF building is 3 floors with a subterranean tunnel that allows for secure inmate movement between the adjacent Jail and the Justice Center courtrooms. Movement of off-sight juvenile detainees to the Justice Center Juvenile Court also uses this tunnel system via stairway access from the secure parking lot along the rear of the Justice Center.

The original construction purposely left the 3rd Floor unfinished and vacant. This plan was to allow for future buildout of the 3rd Floor as the needs of the court system grew over time. The current project is to complete the buildout of the 3rd Floor and to renovate select areas on the active 1st and 2nd floors, as needed to meet the needs of departments which will relocate within the building after the completion of the Buildout Project.

Scope of Work for the 2025 Buildout Project

As stated above, the current project is to complete the buildout of the 3rd Floor and to renovate select areas on the active 1st and 2nd floors, as needed to meet the needs of departments which will relocate within the building after the completion of the Buildout Project.

Security and Access

Due to the need to continue use of the existing courts and supporting offices, the Buildout Project will take place in close proximity to active courtrooms, office spaces, public spaces and within a venue with well established lines of security and areas of restricted access. It will be required that the Contractor maintain and comply with these and other similar operational requirements such that the Court System can continue to function simultaneously with the work required for the current project. All workers, subcontractors, vendors and related staff provided by the Contractor will be subject to security clearance, as required by the Fayette County Sheriff's office (Building Security), prior to being allowed initial access to the building. The work site will also be designated as Drug Free.

In anticipation of the Buildout Project, the original construction provided for a 'knock out' window panel on the vacant third floor. The intent of this removeable panel is to allow the Buildout Contractor *primary* access to the third floor, by way of a temporary exterior construction elevator, directly from the lawn and parking area immediately to the rear of the building. This primary access will provide for free movement of building materials, equipment and labor to and from the work zone without the need to use existing entrances, stairways and elevators dedicated for use by the public and/or by County staff. Surplus bricks have been saved from the original project to allow for proper repair to the "knock out" window panel upon completion of the Buildout Project.
It is anticipated that use of internal stairways, corridors and/or elevators will be necessary at select times during the work on the 3rd floor and during renovation work on the lower floors. This will be allowed subject to scheduling and security approval by the Architect and by the Sheriff's Office.

Scheduling and Sequencing of the Work

The scheduling and sequencing of the work for the current project will be critical to not only completing the project successfully, but most importantly by allowing existing courtrooms and office activities to continue without major disturbances or breaches to restricted access zones, security of the building or security of the court system staff and public visitors.

To accomplish all work within this project, work will need to be sequenced such that new spaces on the 3rd floor are completed first, allowing for movement of court system offices to the new spaces, thus vacating existing spaces on the 2nd floor that are designated for renovation. Similarly, renovation work on the 2nd floor must be completed next such that existing offices on the 1st floor can move to the newly renovated 2nd floor and vacate existing spaces on the 1st floor that are designated for renovation. Offices on the 1st floor that are designated for renovation will be completed last.

The following Sequencing Priority is provided to further illustrate the intended scheduling needs:

1. Establish access to and install temporary, exterior construction elevator.
2. Complete 3rd Floor – Left half (facing rear of building).
3. Perform work on 3rd Floor – Right half, only work that is not disruptive to active offices below.
4. Move Superior Court and D.A. offices from 2nd floor left half to 3rd floor left half (by Owner).
5. Complete renovation to 2nd floor – left half, former D.A. offices.
6. Move State Court and Solicitor offices from right half to left half of 2nd floor (by Owner).
7. Complete 3rd floor – Right half. (2nd floor - right half now vacant)
8. Complete renovations to 2nd floor – right half concurrent with item 7 above.
9. Move Juvenile Court offices from 1st floor to 2nd floor – right half (by Owner).
10. Renovate 1st floor, former Juvenile Court and offices.
11. Move Court Services (Sheriffs Office) and expand Magistrate offices to renovated former Juvenile Court offices (by Owner).
12. Renovate 1st floor, former Court Services, portions of Magistrate and portions of Probate Court offices.
13. Expand Probate Court into renovated former Court Services offices. (by Owner)
14. Expand Clerk of Court into renovated former Magistrate Court offices. (by Owner).
15. Completion of the expanded Judges parking lot and other site improvements.

Note – Waterproofing of existing tunnel can be scheduled independently of the sequencing shown above.

The sequencing priority described above is not intended to affect the Contractor's ability to choose and determine appropriate Means and Methods and is open for discussion should the Contractor feel that there are better ways to accomplish the project intent while maintaining minimum disruption to ongoing building operations.

The intent of completing the left half of the 3rd floor first is to allow for movement of the Superior Courts and D.A. offices from the 2nd floor – left half, to the 3rd floor - left half and movement of the State Court and Solicitor's Offices from the right half to the left half of the 2nd floor. This will essentially vacate the right half of the 2nd floor, allowing for completion of the 3rd floor right half and renovation to the 2nd floor right half to happen concurrently while minimizing disruptions to the active spaces below.

It is anticipated that some work will be required within active office spaces from time to time, (ie – work for new 3rd floor spaces that must be accessed from ceilings of active 2nd floor spaces below.) Scheduling for this type of work will require prior review and approval by the Architect and the Sheriff's Office (Building Security). The Owner's Project Manager will similarly review and coordinate with the individual departments affected by these location specific work items.

The Architect and the County Project Manager will work with the judges and the Clerk of Court to streamline the court calendar, as much as possible, to provide significant gaps when minimal or no courtroom activity will be scheduled for consecutive days or a week or more at a time. This effort will allow the Contractor to plan work that is likely to be disruptive to the courts during these idle periods. It is also anticipated that the Contractor will need to have the flexibility to avoid disruptive work during periods of peak court activity. The Project Manager will share this information with the Contractor on a regular basis, as these calendars become available.

INFORMATION FOR BIDDERS

ALL BIDS must be made on the required BID form. All blank spaces for BID prices must be filled in, in ink or typewritten, and the BID form must be fully completed when submitted. Only one copy of the BID form is required. In case of discrepancy between unit prices and extended prices, unit prices shall prevail. The Engineer will correct any such errors and/or any errors in the summation of the extended prices. The Total Base Bid Amount shall be the sum of the Lump Sum prices, the corrected extended prices, and any pre-printed required allowances.

The OWNER may waive any informalities or minor defects or reject any and all BIDS. Any BID may be withdrawn prior to the above scheduled time for the opening of BIDS or authorized postponement thereof. Any BID received after the time and date specified shall not be considered. No BIDDER may withdraw a BID within 90 days after the actual date of the opening thereof. Should there be reasons why the Contract cannot be awarded within the specified period, the time may be extended by mutual agreement between the OWNER and the BIDDER.

BIDDERS must satisfy themselves of the accuracy of the estimated quantities in the BID Schedule by examination of the site and a review of the drawings and specifications including ADDENDA. After BIDS have been submitted, the BIDDER shall not assert that there was a misunderstanding concerning the quantities of WORK or of the nature of the WORK to be done.

The OWNER shall provide to BIDDERS prior to BIDDING, all information which is pertinent to, and delineates and describes, the land owned and rights-of-way acquired or to be acquired.

The CONTRACT DOCUMENTS contain the provisions required for the construction of the PROJECT. Information obtained from an officer, agent, or employee of the OWNER or any person shall not affect the risks or obligations assumed by the CONTRACTOR or relieve the Contractor from fulfilling any of the conditions of the Contract.

Each BID must be accompanied by a BID Bond payable to the OWNER for five percent of the total amount of the BID. As soon as the BID prices have been compared, the OWNER will return the BONDS of all except the three lowest responsible BIDDERS. When the Agreement is executed the bonds of the two remaining unsuccessful BIDDERS will be returned. The BID BOND of the successful BIDDER will be retained until the payment BOND and performance BOND have been executed and approved, after which it will be returned.

A performance BOND and a payment BOND each in the amount of 100 percent of the CONTRACT PRICE, with a corporate surety approved

by the OWNER, will be required for the faithful performance of the Contract.

Attorney-in-fact who sign BID BONDS or payment BONDS and performance BONDS must file with each BOND a certified and effective dated copy of their power of attorney.

The party to whom the contract is awarded will be required to execute the Agreement and obtain the performance BOND and payment BOND within ten (10) calendar days from the date when NOTICE OF AWARD is delivered to the BIDDER. The NOTICE OF AWARD shall be accompanied by the necessary Agreement and BOND forms. Bidder will also be required to submit at least 2 references of similar work completed in the last five years. In case of failure of the BIDDER to execute the Agreement, the OWNER may consider the BIDDER in default, in which case the BID BOND accompanying the proposal shall become the property of the OWNER.

The OWNER within ten (10) days of receipt of acceptable performance BOND, payment BOND and Agreement signed by the party to whom the Agreement was awarded shall sign the Agreement and return to such party an executed duplicate of the Agreement. Should the OWNER not execute the Agreement within such period, the BIDDER may by WRITTEN NOTICE withdraw the signed Agreement. Such notice of withdrawal shall be effective upon receipt of the notice by the OWNER.

The NOTICE TO PROCEED shall be issued within ten (10) days of the execution of the Agreement by the OWNER. Should there be reasons why the NOTICE TO PROCEED cannot be issued within such period, the time may be extended by mutual agreement between the OWNER AND CONTRACTOR. If the NOTICE TO PROCEED has not been issued within the ten (10) day period or within the period mutually agreed upon, the CONTRACTOR may terminate the Agreement without further liability on the part of either party.

The OWNER may make such investigations as deemed necessary to determine the ability of the BIDDER to perform the WORK, and the BIDDER shall furnish to the OWNER all such information and data for this purpose as the OWNER may request. The OWNER reserves the right

to reject any BID if the evidence submitted by, or investigation of, such BIDDER fails to satisfy the OWNER that such BIDDER is properly qualified to carry out the obligations of the Agreement and to complete the WORK contemplated therein.

A conditional, qualified or obviously unbalanced BID will not be accepted.

Award of the Contract will be made to the lowest responsible BIDDER on the basis of the lowest actual bid amount for the Contract, which is defined as the base bid less any deductions for "allowed" deductive alternates, plus any additions for "allowed" additive alternates listed in the Bid Schedule.

All applicable laws, ordinances, and the rules and regulations of all authorities having jurisdiction over construction of the PROJECT shall apply to the Contract throughout.

Each BIDDER is responsible for inspecting the site and for reading and being thoroughly familiar with the CONTRACT DOCUMENTS. The failure or omission of any BIDDER to do any of the foregoing shall in no way relieve any BIDDER from any obligation in respect to its BID.

The low BIDDER shall supply the names and addresses of major material SUPPLIERS and SUBCONTRACTORS when required to do so by the OWNER.

AGREEMENT

THIS AGREEMENT, made this day of_____, 20___, by and between Fayette County, Georgia hereinafter called "OWNER" and _____ doing business as (an individual), or (a partnership), or (a corporation) hereinafter called "CONTRACTOR".

WITNESSETH: That for and in consideration of the payments and agreements herein after mentioned:

1. The CONTRACTOR will commence and complete the construction of Justice Center Buildout for Fayette County, GEORGIA

2. The CONTRACTOR will furnish all of the materials, supplies, tools, equipment, labor, and other services necessary for the construction and completion of the PROJECT described herein.

3. The CONTRACTOR will commence the work required by the CONTRACT DOCUMENTS within 10 calendar days after the date of the NOTICE TO PROCEED and will work continuously to complete the same within 550 calendar days.

4. The CONTRACTOR agrees to perform all of the WORK described in the CONTRACT DOCUMENTS and comply with the terms therein for the sum of $_____ or as shown in the BID Schedule.

5. The terms "CONTRACT DOCUMENTS" MEANS and includes the following:

(A) Advertisement for BIDS

(B) Information for BIDDERS

(C) BID

(D) Agreement

(E) General Conditions

(F) SUPPLEMENTAL GENERAL CONDITIONS & SPECIAL CONDITIONS

(G) Payment BOND

(H) Performance BOND

(I) NOTICE TO PROCEED

(J) CHANGE ORDER

(K) PLANS AND SPECIFICATIONS prepared or issued by **IPG Architects,** dated: _____

(N) ADDENDA:

No._____, dated _____, 20___.

_____, _____, 20___.

_____, _____, 20___.

6. The OWNER will pay to the CONTRACTOR in the manner and at such times as set forth in the General Conditions such amounts as required by the CONTRACT DOCUMENTS.

7. This Agreement shall be binding upon all parties hereto and their respective heirs, executors, administrators, successors, and assigns.

8. Any dispute which may arise under this agreement shall be resolved under the laws of the State of Georgia and venue shall be

proper in Fayette County, Georgia.

IN WITNESS WHEREOF, the parties hereto have executed or caused to be executed by their duly authorized official, this Agreement in Quadruplicate (four) copies shall be deemed an original on the date first above written.

OWNER:
Fayette County, GEORGIA

BY:_____

NAME:_____

TITLE:_____

(SEAL)
ATTEST:

_____

Name:_____
(Please Print)

Title:_____

Contractor:

_____

BY: _____

NAME _____

(Please Print)

Address:

_____

_____

Employer Identification Number:

_____

(SEAL)

ATTEST:

_____

Name: _____

(Please Print)

GENERAL CONDITIONS

1. DEFINITIONS

1.1 Wherever used in the CONTRACT DOCUMENTS, the following terms shall have the meanings indicated and shall be applicable to both the singular and plural thereof:

1.2 ADDENDA - Written or graphic instruments issued prior to the execution of the Agreement which modify or interpret the CONTRACT DOCUMENTS, DRAWINGS and SPECIFICATIONS, by additions, deletions, clarifications, or corrections.

1.3 BID - The offer or proposal of the BIDDER submitted on the prescribed form setting forth the prices for the WORK to be performed.

1.4 BIDDER - Any person, firm, or corporation submitting a BID For the WORK.

1.5 BONDS - Bid, Performance, and Payment Bonds and other instruments of surety, furnished by the CONTRACTOR and the CONTRACTOR'S surety in accordance with the CONTRACT DOCUMENTS.

1.6 CHANGE ORDER – A written order to the CONTRACTOR authorizing an addition, deletion, or revision in the WORK within the general scope of the CONTRACT DOCUMENTS, or authorizing an adjustment in the CONTRACT PRICE or CONTRACT TIME.

1.7 CONTRACT DOCUMENTS – The contract, including Advertisement for BIDS, Information for BIDDERS, BID, Agreement, Payment BOND, Performance BOND, NOTICE TO PROCEED, CHANGE ORDER, DRAWINGS, SPECIFICATIONS, AND ADDENDA.

1.8 CONTRACT PRICE – The total monies payable to the CONTRACTOR under the terms and conditions of the CONTRACT DOCUMENTS.

1.9 CONTRACT TIME – The number of calendar days stated in the CONTRACT DOCUMENTS for the completion of the WORK.

1.10 CONTRACTOR – The person, firm, or corporation with whom the OWNER has executed the Agreement.

1.11 DRAWINGS – The parts of the CONTRACT DOCUMENTS which show the characteristics and scope of the WORK to be performed and which have been prepared or approved by the ENGINEER.

1.12 ENGINEER/Architect – The person, firm, or corporation named as such in the CONTRACT DOCUMENTS.

1.13 FIELD ORDER – A written order effecting a change in the WORK not involving an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, issued by the ENGINEER to the CONTRACTOR during construction.

1.14 NOTICE OF AWARD – The written notice of the acceptance of the BID from the OWNER to be the successful BIDDER.

1.15 NOTICE TO PROCEED – Written communication issued by the OWNER to the CONTRACTOR authorizing him/her to proceed with the WORK and establishing the date for commencement of the WORK.

1.16 OWNER – A public or quasi-public body or authority, corporation, association, partnership, or an individual for whom the WORK is to be performed.

1.17 PROJECT – The undertaking to be performed as provided in the CONTRACT DOCUMENTS.

1.18 RESIDENT PROJECT REPRESENTATIVE – The authorized representative of the OWNER who is assigned to the PROJECT site or any part thereof.

1.19 SHOP DRAWINGS – All drawings, diagrams, illustrations, brochures, schedules and other data which are prepared by the CONTRACTOR, a SUBCONTRACTOR, manufacturer, SUPPLIER or distributor, which illustrate how specific portions of the WORK shall be fabricated or installed.

1.20 SPECIFICATIONS – A part of the CONTRACT DOCUMENTS consisting of written descriptions of a technical nature of materials, equipment, construction systems, standards and workmanship.

1.21 SUBCONTRACTOR – An individual, firm or corporation having a direct contract with CONTRACTOR or with any other SUBCONTRACTOR for the performance of a part of the WORK at the site.

1.22 SUBSTANTIAL COMPLETION – That date certified by the ENGINEER when the construction of the PROJECT or a specified part thereof is sufficiently completed, in accordance with the CONTRACT DOCUMENTS, so that the PROJECT or specified part can be utilized for the purposes for which it is intended.

1.23 SUPPLEMENTAL GENERAL CONDITIONS – Modifications to General Conditions.

1.24 SUPPLIER – Any person or organization who supplies materials or equipment for the WORK, including that fabricated to a special design, but who does not perform labor at the site.

1.25 WORK – All labor necessary to produce the construction required by the CONTRACT DOCUMENTS, and all materials and equipment incorporated or to be incorporated in the PROJECT.

1.26 WRITTEN NOTICE – Any notice to any party of the Agreement relative to any part of this Agreement in writing and considered delivered and the service thereof completed, when posted by certified or registered mail to the said party at their last given address, or delivered in person to said party or their authorized representative on the WORK.

2. ADDITIONAL INSTRUCTIONS AND DETAIL DRAWINGS

2.1 The CONTRACTOR may be furnished additional instructions and detail drawings, by the ENGINEER, as necessary to carry out the WORK required by the CONTRACT DOCUMENTS.

2.2 The additional drawings and instructions thus supplied will become a part of the CONTRACT DOCUMENTS. The CONTRACTOR shall carry out the WORK in accordance with the additional detail drawings and instructions.

3. SCHEDULES, REPORTS AND RECORDS

3.1 The CONTRACTOR shall submit to the OWNER such schedule of quantities and costs, progress schedules, payrolls, reports, estimates, records and other data where applicable as are required by the CONTRACT DOCUMENTS for the WORK to be performed.

3.2 Prior to the first partial payment estimate the CONTRACTOR shall submit construction progress schedules showing the order in which the CONTRACTOR proposes to carry on the WORK, including dates at which the various parts of the WORK will be started, estimated date of completion of each part and, as applicable:

3.2.1 The dates at which special detail drawings will be required; and

3.2.2 Respective dates for submission of SHOP DRAWINGS, the beginning of manufacture, the testing and the installation of materials, supplies and equipment.

3.3 The CONTRACTOR shall also submit a schedule of payments that the CONTRACTOR anticipates will be earned during the course of the WORK.

4. DRAWINGS AND SPECIFICATIONS

4.1 The intent of the DRAWINGS and SPECIFICATIONS is that the CONTRACTOR shall furnish all labor, materials, tools, equipment, and transportation necessary for the proper execution of the WORK in accordance with the CONTRACT DOCUMENTS and all incidental WORK necessary to complete the PROJECT in an acceptable manner, ready for use, occupancy or operation by the OWNER.

4.2 In case of conflict between the DRAWINGS and SPECIFICATIONS, the SPECIFICATIONS shall govern. Figure dimensions on DRAWINGS shall govern over general DRAWINGS.

4.3 Any discrepancies found between the DRAWINGS and SPECIFICATIONS and site conditions or any inconsistencies or ambiguities in the DRAWINGS or SPECIFICATIONS shall be immediately reported to the ENGINEER, in writing, who shall promptly correct such inconsistencies or ambiguities in writing. WORK done by the CONTRACTOR after discovery of such discrepancies, inconsistencies or ambiguities shall be done at the CONTRACTOR"S risk.

5. SHOP DRAWINGS

5.1 The CONTRACTOR shall provide SHOP DRAWINGS as may be necessary for the prosecution of the WORK as required by the CONTRACT DOCUMENTS. The ENGINEER shall promptly review all SHOP DRAWINGS. The ENGINEER'S approval of any SHOP DRAWINGS shall not release the CONTRACTOR from responsibility for deviations from the CONTRACT DOCUMENTS. The approval of any SHOP DRAWINGS which substantially deviates from the requirement of the CONTRACT DOCUMENTS shall be evidenced by a CHANGE ORDER.

5.2 When submitted for the ENGINEER'S review, SHOP DRAWINGS shall bear the CONTRACTOR'S certification that he has reviewed, checked and approved the SHOP DRAWINGS and that they are in conformance with the requirements of the CONTRACT DOCUMENTS.

5.3 Portions of the WORK requiring a SHOP DRAWING or sample submission shall not begin until the SHOP DRAWING or submission has been approved by the ENGINEER. A copy of each approved SHOP DRAWING and each approved sample shall be kept in good order by the CONTRACTOR at the site and shall be available to the ENGINEER.

6. MATERIALS, SERVICES AND FACILITIES

6.1 It is understood that, except as otherwise specifically stated in the CONTRACT DOCUMENTS, the CONTRACTOR shall provide and pay for all materials, labor, tools, equipment, water, light, power, transportation, supervision, temporary construction of any nature, and all other services and facilities of any nature whatsoever necessary to execute, complete, and deliver the WORK within the specified time.

6.2 Materials supplied by the CONTRACTOR and equipment shall be so stored as to insure the preservation of their quality and fitness for the WORK. Stored materials and equipment to be incorporated in the WORK

shall be located so as to facilitate prompt inspection.

6.3 Manufactured articles, materials, and equipment shall be applied, installed, connected, erected, used, cleaned and conditioned as directed by the manufacturer.

6.4 Materials, supplies, and equipment shall be in accordance with samples submitted by the CONTRACTOR and approved by the ENGINEER.

6.5 Materials, supplies, or equipment to be incorporated into the WORK shall not be purchased by the CONTRACTOR or the SUBCONTRACTOR subject to a chattel mortgage or under a conditional sale contract or other agreement by which any interest is retained by the seller.

7. INSPECTION AND TESTING

7.1 All materials and equipment used in the construction of the PROJECT shall be subject to adequate inspection and testing in accordance with generally accepted standards, as required and defined in the CONTRACT DOCUMENTS.

7.2 The OWNER shall provide all inspection and testing services not required by the CONTRACT DOCUMENTS.

7.3 The CONTRACTOR shall provide at the CONTRACTOR'S expense the testing and inspection services required by the CONTRACT DOCUMENTS.

7.4 If the CONTRACT DOCUMENTS, laws, ordinances, rules, regulations or orders of any public authority having jurisdiction require any WORK to specifically be inspected, tested, or approved by someone other than the CONTRACTOR, the CONTRACTOR will give the ENGINEER timely notice of readiness. The CONTRACTOR will then furnish the ENGINEER the required certificates of inspection, testing or approval.

7.5 Inspections, tests, or approvals by the ENGINEER or others shall not relieve the CONTRACTOR from the obligations to perform the WORK in accordance with the requirements of the CONTRACT DOCUMENTS.

7.6 The ENGINEER and the ENGINEER'S representatives will at all times have access to the WORK. In addition, authorized representatives and agents of any participating Federal or State agency shall be permitted to inspect all work, materials, payrolls,

records or personnel, invoices of materials, and other relevant data and records. The CONTRACTOR will provide proper facilities for such access and observation of the WORK and also for any inspection or testing thereof.

7.7 If any WORK is covered contrary to the written instructions of the ENGINEER it must, if requested by the ENGINEER, be uncovered for the ENGINEER'S observation and replaced at the CONTRACTOR'S expense.

7.8 If the ENGINEER considers it necessary or advisable that covered WORK be inspected or tested by others, the CONTRACTOR, at the ENGINEER'S request, will uncover, expose or otherwise make available for observation, inspection or testing as the ENGINEER may require, that portion of the WORK in question, furnishing all necessary labor, materials, tools, and equipment. If it is found that such WORK is defective, the CONTRACTOR will bear all the expenses of such uncovering, exposure, observation, inspection and testing and of satisfactory reconstruction, if, however, such WORK is not found to be defective, the CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to such uncovering, exposure, observation, inspection, testing and reconstruction and an appropriate CHANGE ORDER shall be issued.

8. SUBSTITUTIONS

8.1 Whenever a material, article, or piece of equipment is identified on the DRAWINGS or SPECIFICATIONS by reference to brand name or catalogue numbers, it shall be understood that this is referenced for the purpose of defining the performance or other salient requirements and that other products of equal capacities, quality and function shall be considered. The CONTRACTOR may recommend the substitution of a material, article, or piece of equipment of equal substance and function for those referred to in the CONTRACT DOCUMENTS by reference to brand name or catalogue number, and if, in the opinion of the ENGINEER, such material, article, or piece of equipment is of equal substance and function to that specified, the ENGINEER may approve its substitution and use by the CONTRACTOR. Any cost differential shall be deductible from the CONTRACT PRICE and the CONTRACT DOCUMENTS shall be appropriately modified by CHANGE ORDER. The CONTRACTOR warrants that if substitutes are approved, no major changes in the function or general

design of the PROJECT will result. Incidental changes or extra component parts required to accommodate the substitute will be made by the CONTRACTOR without a change in the CONTRACT PRICE or CONTRACT TIME.

The ENGINEER and/or OWNER reserves the right to reject any proposed substitution based upon quality or price comparison with specified equipment. The ENGINEER and/or OWNER may also reject any proposed substitution based on previous, unsatisfactory experience with equipment or materials from proposed manufacturer. In the case of such a rejection, the CONTRACTOR shall provide the specified equipment or another approved substitution, at no additional cost to the CONTRACT. CONTRACTOR shall not assume that the terms "or equal" constitutes an automatic approval of a proposed substitution.

9. PATENTS

9.1 The CONTRACTOR shall pay all applicable royalties and license fees, and shall defend all suits or claims for infringement of any patent rights and save the OWNER harmless from loss on account thereof, except that the OWNER shall be responsible for any such loss when a particular process, design, or product of a particular manufacturer or manufacturers is specified, however, if the CONTRACTOR has reason to believe that the design, process or product specified is an infringement of a patent, the CONTRACTOR shall be responsible for such loss unless the CONTRACTOR promptly gives such information to the ENGINEER.

10. SURVEYS, PERMITS, REGULATIONS

10.1 The OWNER shall furnish all boundary surveys and establish all base lines for locating the principal component parts of the WORK together with a suitable number of bench marks adjacent to the WORK as shown in the CONTRACT DOCUMENTS. From the information provided by the OWNER, unless otherwise specified in the CONTRACT DOCUMENTS, the CONTRACTOR shall develop and make all detail surveys needed for construction such as slope stakes, batter boards, stakes for pipe locations and other working points, lines, elevations and cut sheets.

10.2 The CONTRACTOR shall carefully preserve bench marks, reference points and stakes and, in case of willful or careless destruction, shall be charged with the resulting expense and shall be responsible for any

mistake that may be caused by their unnecessary loss or disturbance.

10.3 Permits and licenses of a temporary nature necessary for the prosecution of the WORK shall be secured and paid for by the CONTRACTOR unless otherwise stated in the SUPPLEMENTAL GENERAL CONDITIONS. Permits, licenses and easements for permanent structures or permanent changes in existing facilities shall be secured and paid for by the OWNER, unless otherwise specified. The CONTRACTOR shall give all notices and comply with all laws, ordinances, rules and regulations bearing on the conduct of the WORK as drawn and specified. If the CONTRACTOR observes that the CONTRACT DOCUMENTS are at variance therewith, the CONTRACTOR shall promptly notify the ENGINEER in writing, and any necessary changes shall be adjusted as provided in Section 13, CHANGES IN THE WORK.

11. PROTECTION OF WORK, PROPERTY, AND PERSONS

11.1 The CONTRACTOR will be responsible for initiating, maintaining and supervising all safety precautions and programs in connection with the WORK. The CONTRACTOR will take all necessary precautions for the safety of, will provide the necessary precautions for the safety of, and will provide the necessary protection to prevent damage, injury or loss to all employees on the WORK and other persons who may be affected thereby, all the WORK and all materials or equipment to be incorporated therein, whether in storage on or off the site, and other property at the site or adjacent thereto, including trees, shrubs, lawns, walks, pavements, roadways, structures and utilities not designated for removal, relocation or replacement in the course of construction.

11.2 The CONTRACTOR will comply with all applicable laws, ordinances, rules, regulations and orders of any public body having jurisdiction. The CONTRACTOR will erect and maintain, as required by the conditions and progress of the WORK, all necessary safeguards for safety and protection. The CONTRACTOR will notify OWNERS of adjacent utilities when prosecution of the WORK may affect them. The CONTRACTOR will remedy all damage, injury or loss to any property caused, directly or indirectly, in whole or part, by the CONTRACTOR, any SUBCONTRACTOR or anyone directly or indirectly employed by any of them or anyone of whose acts any of them be liable, except damage or loss attributable to the fault of the CONTRACT DOCUMENTS or to the acts or omissions

of the OWNER, of the ENGINEER or anyone employed by either of them or anyone for whose acts either of them may be liable, and not attributable, directly or indirectly, in whole or in part, to the fault or negligence of the CONTRACTOR.

11.3 In emergencies affecting the safety of persons or the WORK or property at the site or adjacent thereto, the CONTRACTOR, without special instructions or authorization from the ENGINEER Or OWNER, shall act to prevent threatened damage, injury or loss. The CONTRACTOR will give the ENGINEER prompt WRITTEN NOTICE of any significant changes in the WORK or deviations from the CONTRACT DOCUMENTS caused thereby, and a CHANGE ORDER shall thereupon be issued covering the changes and deviations involved.

12. SUPERVISION BY CONTRACTOR

12.1 The CONTRACTOR will supervise and direct the WORK. He will be solely responsible for the means, methods, techniques, sequences and procedures of construction. The CONTRACTOR will employ and maintain on the WORK a qualified supervisor or superintendent who shall have been designated in writing by the CONTRACTOR as the CONTRACTOR'S representative at the site. The supervisor shall have full authority to act on behalf of the CONTRACTOR and all communications given to the supervisor shall be as binding as if given to the CONTRACTOR. The supervisor shall be present on the site at all times as required to perform adequate supervision and coordination of the WORK.

13. CHANGES IN THE WORK

13.1 The OWNER may at any time, as the need arises, order changes within the scope of the WORK without invalidating the Agreement. If such changes increase or decrease the amount due under the CONTRACT DOCUMENTS, or in the time required for performance of the WORK, an equitable adjustment shall be authorized by CHANGE ORDER.

13.2 The ENGINEER, also, may at any time, by issuing a FIELD ORDER, make changes in the details of the WORK. The CONTRACTOR shall proceed with the performance of any changes in the WORK so ordered by the ENGINEER unless the CONTRACTOR believes that such FIELD ORDER entitles the CONTRACTOR to a change in CONTRACT PRICE or TIME, or both, in which event the CONTRACTOR shall give the ENGINEER WRITTEN NOTICE thereof within seven (7) days

after the receipt of the ordered change. Thereafter the CONTRACTOR shall document the basis for the change in CONTRACT PRICE OR TIME within thirty (30) days. The CONTRACTOR shall not execute such changes pending the receipt of an executed CHANGE ORDER for further instruction from the OWNER.

14. CHANGES IN CONTRACT PRICE

14.1 The CONTRACT PRICE may be changed only by a CHANGE ORDER. The value of any WORK covered by a CHANGE ORDER or of any claim for increase or decrease in the CONTRACT PRICE shall be determined by one or more of the following methods in the order of precedence listed below:

a. Unit prices previously approved.
b. An agreed lump sum.

15. TIME FOR COMPLETION AND LIQUIDATED DAMAGES

15.1 The date of beginning and the time for completion of the WORK are essential conditions of the CONTRACT DOCUMENTS.

15.2 The CONTRACTOR will proceed with the WORK at such rate of progress to insure full completion within the CONTRACT TIME. It is expressly understood and agreed, by and between the CONTRACTOR and the OWNER, that the CONTRACT TIME for the completion of the WORK described herein is a reasonable time, taking into consideration the average climatic and economic conditions and other factors prevailing in the locality of the WORK.

15.3 If the CONTRACTOR shall fail to complete the WORK within the CONTRACT TIME, or extension of time granted by the OWNER, then the CONTRACTOR will pay to the OWNER the amount for liquidated damages as specified in the BID for each calendar day that the CONTRACTOR shall be in default after the time stipulated in the CONTRACT DOCUMENTS. In addition to Liquidated Damages, the CONTRACTOR shall reimburse the ENGINEER for additional inspection and engineering services required due to overrun of the contract time, or the overrun of approved extension of contract time. This will be paid at 2.5 times the direct expense to the ENGINEER and will be withheld from the CONTRACTOR'S monthly pay request. The OWNER will pay the ENGINEER directly from the withheld amount.

15.4 The CONTRACTOR shall not be charged with liquidated

damages or any excess cost or any payment to the ENGINEER when the delay in completion of the WORK is due to the following and the CONTRACTOR has promptly given WRITTEN NOTICE of such delay to the OWNER or ENGINEER.

15.4.1 To any preference, priority or allocation order duly issued by the OWNER.

15.4.2 To unforeseeable causes beyond the control and without the fault or negligence of the CONTRACTOR, including but not restricted to, acts of God or of the public enemy, acts of the OWNER, acts of another CONTRACTOR in the performance of a contract with the OWNER, fires, floods, epidemics, quarantine restrictions, strikes, freight embargoes, and abnormal and unforeseeable weather; and

15.4.3 To any delays of SUBCONTRACTORS occasioned by any of the causes specified in paragraphs 15.4.1 and 15.4.2 of this article.

16. CORRECTION OF WORK

16.1 The CONTRACTOR shall promptly remove from the premises all WORK rejected by the ENGINEER for failure to comply with the CONTRACT DOCUMENTS, whether incorporated in the construction or not, and the CONTRACTOR shall promptly replace and re-execute the WORK in accordance with the CONTRACT DOCUMENTS and without expense to the OWNER and shall bear the expense of making good all WORK of other CONTRACTORS destroyed or damaged by such removal or replacement.

16.2 All removal and replacement WORK shall be done at the CONTRACTOR'S expense. If the CONTRACTOR does not take action to remove such rejected WORK within ten (10) days after receipt of WRITTEN NOTICE, the OWNER may remove such WORK and store the materials at the expense of the CONTRACTOR.

17. SUBSURFACE CONDITIONS

17.1 The CONTRACTOR shall promptly, and before such conditions are disturbed, except in the event of an emergency, notify the OWNER by WRITTEN NOTICE of:

17.1.1 Subsurface or latent physical conditions at the site differing materially from those indicated in the CONTRACT DOCUMENTS; or

17.1.2 Unknown physical conditions at the site, of an unusual nature, differing materially from those ordinarily encountered and generally recognized as inherent in WORK of the character provided for in the CONTRACT DOCUMENTS.

17.2 The OWNER shall promptly investigate the conditions, and if it is found that such conditions do so materially differ and cause an increase or decrease in the cost of, or in the time required for, performance of the WORK, an equitable adjustment shall be made and the CONTRACT DOCUMENTS shall be modified by a CHANGE ORDER. Any claim of the CONTRACTOR for adjustment hereunder shall not be allowed unless the required WRITTEN NOTICE has been given; provided that the OWNER may, if the OWNER determines the facts so justify, consider and adjust any such claims asserted before the date of final payment.

18. SUSPENSION OF WORK, TERMINATION, AND DELAY

18.1 The OWNER may suspend the WORK or any portion thereof for a period of not more than ninety days or such further time as agreed upon by the CONTRACTOR, by WRITTEN NOTICE to the CONTRACTOR and the ENGINEER which shall fix the date on which WORK shall be resumed. The CONTRACTOR will resume that WORK on the date so fixed. The CONTRACTOR will be allowed an increase in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, directly attributable to any suspension.

18.2 If the CONTRACTOR is adjudged as bankrupt or insolvent, or makes a general assignment for the benefit of its creditors, or if a trustee or receiver is appointed for the CONTRACTOR or for any of its property, or if CONTRACTOR files a petition to take advantage of any debtor's act, or to reorganize under the bankruptcy or applicable laws, or repeatedly fails to supply sufficient skilled workmen or suitable materials or equipment, or repeatedly fails to make prompt payments to SUBCONTRACTORS or for labor, materials or equipment or disregards laws, ordinances, rules, regulations or orders of any public body having jurisdiction of the WORK or disregards the authority of the ENGINEER, or otherwise violates any provision of the CONTRACT DOCUMENTS, then the OWNER may, without prejudice to any other right or remedy and after giving the CONTRACTOR and its surety a minimum of ten (10) days from delivery of a WRITTEN NOTICE, terminate the services of the CONTRACTOR and take possession of the PROJECT and of all materials, equipment, tools, construction equipment

and machinery thereon owned by the CONTRACTOR, and finish the WORK by whatever method the OWNER may deem expedient. In such case the CONTRACTOR shall not be entitled to receive any further payment until the WORK is finished. If the unpaid balance of the CONTRACT PRICE exceeds the direct and indirect costs of completing the PROJECT, including compensation for additional professional services, such excess SHALL BE PAID TO THE CONTRACTOR. If such costs exceed such unpaid balance, the CONTRACTOR will pay the difference to the OWNER. Such costs incurred by the OWNER will be determined by the ENGINEER and incorporated in a CHANGE ORDER.

18.3 Where the CONTRACTOR'S services have been so terminated by the OWNER, said termination shall not affect any right of the OWNER against the CONTRACTOR then existing or which may thereafter accrue. Any retention or payment of monies by the OWNER due the CONTRACTOR will not release the CONTRACTOR from compliance with the CONTRACT DOCUMENTS.

18.4 After ten (10) days from delivery of a WRITTEN NOTICE to the CONTRACTOR and the ENGINEER, the OWNER may without cause and without prejudice to any other right or remedy, elect to abandon the PROJECT and terminate the contract. In such case the CONTRACTOR shall be paid for all WORK executed and any expense sustained plus reasonable profit.

18.5 If, through no act or fault of the CONTRACTOR, the WORK is suspended for a period of more than ninety (90) days by the OWNER or under an order of court or other public authority, or the ENGINEER fails to act on any request for payment within thirty (30) days after it is submitted, or the OWNER fails to pay the CONTRACTOR substantially the sum approved by the ENGINEER or awarded by arbitrators within thirty (30) days of its approval and presentation, then the CONTRACTOR may, after ten (10) days from delivery of a WRITTEN NOTICE to the OWNER and the ENGINEER terminate the contract and recover from the OWNER payment for all WORK executed and all expenses sustained. In addition and in lieu of terminating the contract, if the ENGINEER has failed to act on a request for payment or if the OWNER has failed to make any payment as aforesaid, the CONTRACTOR may upon ten (10) days WRITTEN NOTICE to the OWNER and the ENGINEER stop the WORK until paid all amounts then due, in which event and upon resumption of the WORK CHANGE ORDERS shall be issued for adjusting the CONTRACT PRICE or extending the CONTRACT TIME or

both to compensate for the costs and delays attributable to the stoppage of the WORK.

18.6 If the performance of all or any portion of the WORK is suspended, delayed, or interrupted as a result of a failure of the OWNER or ENGINEER to act within the time specified in the CONTRACT DOCUMENTS, or if no time is specified, within a reasonable time, an adjustment in the CONTRACT PRICE or an extension of the CONTRACT TIME, or both, shall be made by CHANGE ORDER to compensate the CONTRACTOR for the costs and delays necessarily caused by the failure of the OWNER or ENGINEER.

19. PAYMENT TO CONTRACTOR

19.1 At least ten (10) days before each progress payment falls due (but not more often than once a month), the CONTRACTOR will submit to the ENGINEER a partial payment estimate filled out and signed by the CONTRACTOR covering the WORK performed during the period covered by the partial payment estimate and supported by such data as the ENGINEER may reasonably require. If payment is requested on the basis of materials and equipment not incorporated in the WORK but delivered and suitably stored at or near the site, the partial payment estimate shall also be accompanied by such supporting data, satisfactory to the OWNER, as will establish the OWNER'S title to the material and equipment and protect the OWNER'S interest therein, including applicable insurance. The ENGINEER will, within ten (10) days after receipt of each partial payment estimate, either indicate in writing approval of payment, and present the partial payment estimates to the OWNER, or return the partial payment estimate to the CONTRACTOR indicating in writing the reasons for refusing to approve payment. In the latter case, the CONTRACTOR may make the necessary corrections and re-submit the partial payment estimate. The OWNER will, within thirty(30) days of presentation of an approved partial payment estimate, pay the CONTRACTOR a progress payment on the basis of the approved partial payment estimate less the retainage. The retainage shall be an amount equal to 5% of said estimate.

The retainage amount withheld in the Contractor's Application for Payments shall be invested by the Owner at the current market rate for the duration of the Project. If the Project is completed within the time limits specified and at the Contract Price specified, subject to any authorized modification thereto, the interest earned on the retainage shall be paid to the Contractor. Any expenses charged by the financial institution for the retainage investment account will be deducted from the interest earned on the account. Payment of the interest to the Contractor shall be made with the final payment, after the Engineer certifies that the Work, including incomplete minor items remaining after substantial completion, has been completed. If the Contractor does not satisfy the time and/or price conditions, the Owner will retain the interest earned on retainage. When the WORK has been substantially completed except for WORK which cannot be completed because of weather conditions, lack of materials or other reasons which in the judgment of the OWNER are valid reasons for non-completion, the OWNER may make additional payments, retaining at all times an amount sufficient to cover the estimated cost of the WORK still to be completed.

19.2 The request for payment may also include an allowance for the cost of such major materials and equipment which are suitably stored either at or near the site.

19.3 Prior to SUBSTANTIAL COMPLETION, the OWNER, with the approval of the ENGINEER and with the concurrence of the CONTRACTOR, may use any completed or substantially completed portions of the WORK. Such use shall not constitute an acceptance of such portions of the WORK.

19.4 The OWNER shall have the right to enter the premises for the purpose of doing WORK not covered by the CONTRACT DOCUMENTS. This provision shall not be construed as relieving the CONTRACTOR of the sole responsibility for the care and protection of the WORK, or the restoration of any damaged WORK except such as may be caused by agents or employees of the OWNER.

19.5 Upon completion and acceptance of the WORK, the ENGINEER shall issue a certificate attached to the final payment request that the WORK has been accepted under the conditions of the CONTRACT DOCUMENTS. The entire balance found to be due the CONTRACTOR, including the retained percentages, but except such sums as may be lawfully retained by the OWNER, shall be

paid to the CONTRACTOR within thirty (30) days of completion and acceptance of the WORK.

19.6 The CONTRACTOR will indemnify and save the OWNER or the OWNER'S agents harmless from all claims growing out of the lawful demand of SUBCONTRACTORS, laborers, workmen, mechanics, materialmen, and furnishers of machinery and parts thereof, equipment, tools, and all supplies, incurred in the furtherance of the performance of the WORK. The CONTRACTOR shall, at the OWNER'S request, furnish satisfactory evidence that all obligations of the nature designated above have been paid, discharged, or waived. If the CONTRACTOR fails to do so the OWNER may, after having notified the CONTRACTOR, either pay unpaid bills or withhold from the CONTRACTOR'S unpaid compensation a sum of money deemed reasonably sufficient to pay any and all such lawful claims until satisfactory evidence is furnished that all liabilities have been fully discharged whereupon payment to the CONTRACTOR shall be resumed in accordance with the terms of the CONTRACT DOCUMENTS, but in no event shall the provisions of this sentence be construed to impose any obligations upon the OWNER to either the CONTRACTOR, the CONTRACTOR'S Surety, or any third party. In paying any unpaid bills of the CONTRACTOR, any payment so made by the OWNER shall be considered as a payment made under the CONTRACT DOCUMENTS by the OWNER to the CONTRACTOR and the OWNER shall not be liable to the CONTRACTOR for any such payments made in good faith.

19.7 If the OWNER fails to make payment thirty (30) days after approval by the ENGINEER, in addition to other remedies available to the CONTRACTOR, there shall be added to each such payment interest at 1% per month, commencing on the first day after said payment is due and continuing until the payment is received by the CONTRACTOR.

20. ACCEPTANCE OF FINAL PAYMENT AS RELEASE

20.1 The acceptance by the CONTRACTOR of final payment shall be and shall operate as a release to the OWNER of all claims and all liability to the CONTRACTOR other than claims in stated amounts as may be specifically excepted by the CONTRACTOR for all things done or furnished in connection with this WORK and for every act and neglect of the OWNER and others relating to or arising out of this WORK. Any payment, however, final or otherwise, shall not release the CONTRACTOR or its sureties from any obligations under the CONTRACT

DOCUMENTS or the Performance and Payment BONDS.

21. INSURANCE

21.1 The CONTRACTOR shall purchase and maintain such insurance as will protect it from claims set forth below which may arise out of, or result from, the CONTRACTOR'S execution of the WORK, whether such execution be by the CONTRACTOR, any SUBCONTRACTOR, or by anyone directly or indirectly employed by any of them, or by anyone for whose acts any of them may be liable:

21.1.1 Claims under workmen's compensation, disability benefit and other similar employee benefit acts;

21.1.2 Claims for damages because of bodily injury, occupational sickness or disease, or death of employees;

21.1.3 Claims for damages because of bodily injury, sickness or disease, or death of any person other than employees;

21.1.4 Claims for damages insured by usual personal injury liability coverage which are sustained (1) by any person as a result of an offense directly or indirectly related to the employment of such person by the CONTRACTOR, or (2) by any other person; and

21.1.5 Claims for damages because of injury to or destruction of tangible property, including loss of use resulting therefrom.

21.2 Certificates of Insurance acceptable to the OWNER shall be filed with the OWNER prior to commencement of the WORK. These Certificates shall contain a provision that coverages afforded under the policies will not be canceled unless at least fifteen (15) days prior WRITTEN NOTICE has been given to the OWNER.

21.3 The CONTRACTOR shall procure and maintain, at the CONTRACTOR'S own expense, during the CONTRACT TIME, liability insurance as hereinafter specified:

21.3.1 CONTRACTOR'S General Public Liability and Property Damage Insurance including vehicle coverage issued to the CONTRACTOR and protecting the CONTRACTOR from all claims for personal injury, including death, and all claims for destruction of or damage to property, arising out of or in connection with any operations

under the CONTRACT DOCUMENTS, whether such operations be by the CONTRACTOR or by any SUBCONTRACTOR employed by the CONTRACTOR or anyone directly or indirectly employed by the CONTRACTOR or by a SUBCONTRACTOR employed by the CONTRACTOR. Insurance shall be written with a limit of liability of not less than $1,000,000 for all damages arising out of bodily injury, including death, at any time resulting therefrom, sustained by any one person in any one accident; and a limit of liability of not less than $1,000,000 aggregate for any such damages sustained by two or more persons in any one accident. Insurance shall be written with a limit of liability of not less than $500,000 for all property damage sustained by any one person in any one accident; and a limit of liability of not less than $500,000 aggregate for any such damage sustained by two or more persons in any one accident.

21.3.2 The CONTRACTOR shall acquire and maintain, Fire and Extended Coverage insurance upon the PROJECT to the full insurable value thereof for the benefit of the OWNER, the CONTRACTOR, and SUBCONTRACTORS as their interest may appear. This provision shall in no way release the CONTRACTOR or CONTRACTOR'S surety from obligations under the CONTRACT DOCUMENTS to fully complete the PROJECT.

21.4 The CONTRACTOR shall procure and maintain, at the CONTRACTOR'S own expense, during the CONTRACT TIME, in accordance with the provisions of the laws of the state in which the WORK is performed, Workmen's Compensation Insurance, including occupational disease provisions, for all of the CONTRACTOR'S employees at the site of the PROJECT and in case any WORK is sublet, the CONTRACTOR shall require such SUBCONTRACTOR similarly to provide Workmen's Compensation Insurance, including occupational disease provisions for all of the latter's employees unless such employees are covered by the protection afforded by the CONTRACTOR. In case any class of employees engaged in hazardous WORK under this contract at the site of the PROJECT is not protected under Workmen's Compensation statue, the CONTRACTOR shall provide, and shall cause each SUBCONTRACTOR to provide, adequate and suitable insurance for the protection of its employees not otherwise protected.

21.5 The CONTRACTOR shall secure, "All Risk" type Builder's Risk Insurance for WORK to be performed. Unless specifically authorized by the OWNER, the amount of such insurance shall not be less than the CONTRACT PRICE totaled in the BID. The policy shall cover not

less than the losses due to fire, explosion, hail, lightning, vandalism, malicious mischief, wind, collapse, riot, aircraft, and smoke during the CONTRACT TIME, and until the WORK is accepted by the OWNER. The policy shall name as the insured the CONTRACTOR, and the OWNER.

22. CONTRACT SECURITY

22.1 The CONTRACTOR shall within ten (10) days after the receipt of the NOTICE OF AWARD furnish the OWNER with a Performance BOND and a Payment BOND in penal sums equal to the amount of the CONTRACT PRICE, conditioned upon the performance by the CONTRACTOR of all undertakings, covenants, terms, conditions and agreements of the CONTRACT DOCUMENTS, and upon the prompt payment by the CONTRACTOR to all persons supplying labor and materials in the prosecution of the WORK provided by the CONTRACT DOCUMENTS. Such BONDS shall be executed by the CONTRACTOR and a corporate bonding company licensed to transact such business in the state in which the WORK is to be performed and named on the current list of "Surety Companies Acceptable on Federal Bonds" as published in the Treasury Department Circular Number 570. The expense of these BONDS shall be borne by the CONTRACTOR. If at any time a surety on any such BOND is declared a bankrupt or loses its right to do business in the state in which the WORK is to be performed or is removed from the list of Surety Companies accepted on Federal Bonds, CONTRACTOR shall within ten (10) days after notice from the OWNER to do so, substitute an acceptable BOND (or BONDS) in such form and sum and signed by such other surety or sureties as may be satisfactory to the OWNER. The premiums on such BOND shall be paid by the CONTRACTOR. No further payment shall be deemed due nor shall be made until the new surety or sureties shall have furnished an acceptable BOND to the OWNER.

23. ASSIGNMENTS

23.1 Neither the CONTRACTOR nor the OWNER shall sell, transfer, assign, or otherwise dispose of the Contract or any portion thereof, or of any right, title or interest therein, or any obligations thereunder, without written consent of the other party.

24. INDEMNIFICATION

24.1 The CONTRACTOR will indemnify and hold harmless the OWNER and the ENGINEER and their agents and employees

from an against all claims, damages, losses and expenses including attorney's fees arising out of or resulting from the performance of the WORK, provided that any such claims, damage, loss or expense is attributable to bodily injury, sickness, disease or death, or to injury to or destruction of tangible property including the loss of use resulting therefrom; and is caused in whole or in part by any negligent or willful act or omission of the CONTRACTOR, and SUBCONTRACTOR, anyone directly or indirectly employed by any of them or anyone for whose acts any of them may be liable.

24.2 In any and all claims against the OWNER or the ENGINEER, or any of their agents or employees, by any employee of the CONTRACTOR, any SUBCONTRACTOR, anyone directly or indirectly employed by any of them, or anyone for whose acts any of them may be liable, the indemnification obligation shall not be limited in any way by any limitation on the amount or type of damages, compensation or benefits payable by or for the CONTRACTOR or any SUBCONTRACTOR under Workmen's Compensation acts, disability benefit acts or other employee benefits acts.

24.3 The obligation of the CONTRACTOR under this paragraph shall not extend to the liability of the ENGINEER, its agents or employees arising out of the preparation or approval of maps, DRAWINGS, opinions, reports, surveys, CHANGE ORDERS, designs or SPECIFICATIONS.

25. SEPARATE CONTRACTS

25.1 The OWNER reserves the right to let other contracts in connection with this PROJECT. The CONTRACTOR shall afford other CONTRACTORS reasonable opportunity for the introduction and storage of their materials and the execution of their WORK, and shall properly connect and coordinate the WORK with theirs.

If the proper execution or results of any part of the CONTRACTOR'S WORK depends upon the WORK of any other CONTRACTOR, the CONTRACTOR shall inspect and promptly report to the ENGINEER any defects in such WORK that render it unsuitable for such proper execution and results.

25.2 The OWNER may perform additional WORK related to the PROJECT or the OWNER may let other contracts containing provisions similar to these. The CONTRACTOR will afford the other CONTRACTOR'S who are parties to such

Contracts (or the OWNER, if the OWNER is performing the additional WORK) reasonable opportunity for the introduction and storage of materials and equipment and the execution of WORK, and shall properly connect and coordinate the WORK with theirs.

25.3 If the performance of additional WORK by other CONTRACTOR'S or the OWNER is not noted in the CONTRACT DOCUMENTS prior to the execution of the CONTRACT, written notice thereof shall be given to the CONTRACTOR prior to starting any such additional WORK. If the CONTRACTOR believes that the performance of such additional WORK by the OWNER or others involves it in additional expense or entitles it to an extension of the CONTRACT TIME, the CONTRACTOR may make a claim thereof as provided in Sections 14 and 15.

26. SUBCONTRACTING

26.1 The CONTRACTOR may utilize the services of specialty SUBCONTRACTS on those parts of the WORK which, under normal contracting practices, are performed by specialty SUBCONTRACTORS.

26.2 The CONTRACTOR shall not award WORK to SUBCONTRACTOR(s), in excess of fifty (50%) percent of the CONTRACT PRICE, without prior written approval of the OWNER.

26.3 The CONTRACTOR shall be fully responsible to the OWNER for the acts and omissions of its SUBCONTRACTORS, and of persons either directly or indirectly employed by them, as the CONTRACTOR is for the acts and omissions of persons directly employed by it.

26.4 The CONTRACTOR shall cause appropriate provisions to be inserted in all subcontracts relative to the WORK to bind SUBCONTRACTORS to the CONTRACTOR by the terms of the CONTRACT DOCUMENTS insofar as applicable to the WORK of SUBCONTRACTORS and give the CONTRACTOR the same power as regards terminating any subcontract that the OWNER may exercise over the CONTRACTOR under any provision of the CONTRACT DOCUMENTS.

26.5 Nothing contained in this CONTRACT shall create any contractual relation between any SUBCONTRACTOR and the OWNER.

27. ENGINEER'S AUTHORITY

27.1 The ENGINEER shall act as the OWNER'S representative

during the construction period, shall decide questions which may arise as to quality and acceptability of materials furnished and WORK performed, and shall interpret the intent of the CONTRACT DOCUMENTS in a fair and unbiased manner. The ENGINEER will make visits to the site and determine if the WORK is proceeding in accordance with the CONTRACT DOCUMENTS.

27.2 The CONTRACTOR will be held strictly to the intent of the CONTRACT DOCUMENTS in regard to the quality of materials, workmanship, and execution of the WORK. Inspections may be at the factory or fabrication plant of the source of material supply.

27.3 The ENGINEER will not be responsible for the construction means, controls, techniques, sequences, procedures, or construction safety.

27.4 The ENGINEER shall promptly make decisions relative to interpretation of the CONTRACT DOCUMENTS.

28. LAND AND RIGHTS-OF-WAY

28.1 Prior to issuance of NOTICE TO PROCEED, the OWNER shall obtain all land and rights-of-way necessary for carrying out and for the completion of the WORK to be performed pursuant to the CONTRACT DOCUMENTS, unless otherwise mutually agreed.

28.2 The OWNER shall provide to the CONTRACTOR information which delineates and describes the lands owned and rights-of-way acquired.

28.3 The CONTRACTOR shall provide at its own expense and without liability to the OWNER any additional land and access thereto that the CONTRACTOR may desire for temporary construction facilities, or for storage of materials.

29. GUARANTEE

29.1 The CONTRACTOR shall guarantee all materials supplied by the CONTRACTOR and equipment furnished and WORK performed for a period of one (1) year from the date of SUBSTANTIAL COMPLETION. The CONTRACTOR warrants and guarantees for a period of one (1) year from the date of SUBSTANTIAL COMPLETION of the system that the completed system is free from all defects due to faulty materials supplied by the CONTRACTOR or workmanship and the CONTRACTOR shall promptly make such corrections as may be necessary by reason of such defects including

the repairs of the damage of other parts of the system resulting from such defects.

The OWNER will give notice of observed defects with reasonable promptness. In the event that the CONTRACTOR should fail to make such repairs, adjustments, or other WORK that may be made necessary by such defects, the OWNER may do so and charge the CONTRACTOR the cost thereby incurred. The Performance BOND shall remain in full force and effect through the guarantee period.

SUPPLEMENTAL GENERAL CONDITIONS

1. CONTRACT CHANGES

All changes which affect the cost of the construction of the project must be authorized by means of a Contract Change Order. The Contract Change Order will include extra work, work for which quantities have been altered from those shown in the bidding schedule, as well as decreases or increases in the quantities of installed units which are different than those shown in the Bidding Schedule because of final measurements. All changes should be recorded on a contract change order as they occur so they may be included in the partial payment estimate. All contract change orders must be approved by the ENGINEER and OWNER.

2. PROTECTION OF LIVES AND PROPERTY

A. In order to protect the lives and health of its employees under the Contract, the CONTRACTOR shall comply with all pertinent provisions of the "Manual of Accident Prevention in Construction" issued by the Associated General Contractors of America, Inc., and shall maintain an accurate record of all cases of death, occupational disease, and injury requiring medical attention or causing loss of time from work, arising out of and in the course of employment or work under the Contract.

3. The CONTRACTOR alone shall be responsible for the safety, efficiency, and adequacy of its plant, appliances, and methods, and for any damage which may result from their failure or their improper construction, maintenance, or operation.

4. No official of the OWNER who is authorized in such capacity and on behalf of the OWNER to negotiate, make, accept, or approve, or to take part in negotiating, making, accepting, or approving any architectural, engineering, inspecting, construction or material supply contract or any subcontract in connection with the construction of the project, shall become directly or indirectly interested personally in this contract or in any part thereof. No officer, employee, architect, attorney, engineer, or inspector of or for the OWNER who is authorized in such capacity and on behalf of the OWNER who is in any legislative, executive, supervisory, or other similar functions in connection with the construction of the project, shall become directly or indirectly interested personally in this contract, or in any part thereof, any material supply contract, subcontract, insurance contract, or any other contract pertaining to the project.

5. The ENGINEER may withhold or, on account of subsequently discovered evidence, nullify the whole or part of any approved partial payment estimate to such extent as may be necessary to protect the OWNER from loss on account of:
   A. Defective work not remedied.
   B. Claims filed or reasonable evidence indicating probable filing of claims.
   C. Failure of CONTRACTOR to make payments properly to subcontractors or for material or labor.
   D. A reasonable doubt that the WORK can be completed for the balance then unpaid.
   E. Damage to another contractor.
   F. Performance of work in violation of the terms of the CONTRACT DOCUMENTS.

6. Where work on unit price items are substantially complete but lack clean-up and/or corrections ordered by the ENGINEER, amounts shall be deducted from unit prices in partial payment estimates to amply cover such clean-up and corrections.

7. When the above grounds in (5) and (6) are cured, payment shall be made for amounts withheld because of them.

SPECIAL CONDITIONS

1. DESCRIPTION OF WORK

It is the intent of these Plans and Specifications that the Contractor shall perform all incidental items of Work and furnish all items of incidental material, and equipment required to construct the completed Project even though such items are not covered in detail in the Contract Documents.

Due to the nature of the project and the potential for unforeseen conditions, it is anticipated that some additional work may be required. A $250,000.00 allowance for additional work is to be included in the Base Bid, to be used to cover Change Orders resulting from such additional work. These allowances apply only to additional work not shown on the Drawings or required by the Specifications. Should such additional work become evident during the conduct of the work, a cost to correct such work shall be established and if the Owner agrees to incorporate the Work in this Contract, a Change Order will be issued. The amount of the Change order will be deducted from the appropriate allowance. At the end of the job, if any allowance remains unused, a Change Order will be issued decreasing the Contract amount by the amount of the unused allowance.

2. COORDINATION OF WORK

The individual Contractor is responsible for the proper coordination of the Work. The OWNER and the ENGINEER will assist in coordinating the Work schedules, but will not be responsible for proper cooperation and coordination of any Work. Any additional work, expense or delay due to lack of coordination will be the sole responsibility of the Contractor.

3. SPECIAL NOTICE

Bidders are required to inform themselves fully of all laws, ordinances, and conditions relating to the work.

Bidders are requested to visit the site and inform themselves as to all conditions, and failure to do so will in no way releive the successful bidder or bidders from the necessity of furnishing any materials or performing any work that may be required to complete the work in accordance with the true intent and meaning of the Plans and Specifications without additional cost to the OWNER.

4. SUBSURFACE CONDITIONS

It is not represented that the Plans show all underground structures, and whenever necessary the Contractor shall make all explorations and excavations for such purposes, at his own expense. Any subsurface information furnished is for the general information of the bidders and is not guaranteed. Unforeseen conditions shall not constitute a claim for increased compensation under the terms of the Contract, nor constitute a basis for cancellation thereof.

5. SCHEDULING

Scheduling and sequencing of the work shall be done such that a continuous, concerted effort is made towards completion of the work. Extended pauses or delays in the work schedule, other than those beyond the control of the Contractor, will not be permitted.

6. COORDINATION WITH UTILITIES

Existing utilities and services shall be protected and maintained by all necessary measures in working condition.

7. LINES AND GRADES

The ENGINEER will furnish sufficient bench marks and dimensions to enable the Contractor to layout the necessary construction lines from the information shown on the Plans. The Contractor shall be responsible for the preservation of all points and elevations furnished and shall bear the expense of setting same if, through negligence or carelessness on his part, they are destroyed. The Contractor shall satisfy himself as to the accuracy of all elevations and points furnished and shall not take advantage of any errors that may have been made.

All lines and grades shall be subject to checking by the ENGINEER, but this checking shall in no way relieve the Contractor from his responsibility for their correctness. The Contractor shall provide such stakes, material, etc., and such field men, and assistance as the ENGINEER may require to establish bench marks and checking and measuring the work.

8. WARNING AND SIGNALS

The Contractor shall be responsible for all signals to the public while the work is in progress, and shall keep amber lights during the entire night at such points as may be

necessary; and he shall provide watchmen, signboards, variable message boards, fences, etc., and shall take any precautions that may be necessary to protect life and property.

9. CONSTRUCTION EQUIPMENT

The Contractor shall provide all necessary equipment in good repair for the expedient construction of the work. Any equipment not adapted for the work, or in such repair as to be dangerous to the work or workers shall not be used.

10. TRAFFIC CONTROL

The Contractor shall develop and implement traffic control plans and programs as necessary to provide, erect, and maintain, all necessary barricades, suitable and sufficient lights, danger signals, signs, variable message boards, pilot vehicles, flagmen and other control devices, and take all necessary precautions for the protection of the work and the safety of the public. A minimum of one lane shall remain open to traffic at all times. Traffic control measures shall be in compliance with the manual for uniform traffic control devices (M.U.T.C.D.), latest edition.

11. SANITARY PROVISIONS

The Contractor shall provide and maintain in a neat and sanitary condition such accommodations for the use of his employees as necessary to comply with the Regulations of the State Board of Health and all local ordinances. No nuisances will be permitted.

12. SPECIAL INSPECTION

Representatives of the OWNER and the ENGINEER shall have access to the work whenever it is in preparation or progress, and the Contractor will provide proper facilities for such access and inspection.

13. PLANS AND SPECIFICATIONS

The ENGINEER shall furnish to the Contractor, free of charge, six(6) copies of the Plans and Specifications. If additional copies are desired by the Contractor, they will be furnished at his expense. The Contractor shall keep one copy of the Plans and Specifications on the site of the work in good order, available to the ENGINEER and to their representatives.
All Plans, Specifications, and copies thereof furnished by the ENGINEER are their property. They are not to be used on

other work, and with the exception of the signed Contract Set are to be returned to them on request, at the completion of the work.

14. ENVIRONMENTAL PROTECTION

During construction the Contractor shall provide silt barriers, and/or other preventive measures as may be required by governing laws or ordinances to prevent siltation and soil erosion. All such work shall be done without additional cost to the OWNER.

The Contractor will restore all disturbed areas to their present or better condition upon completion of construction.

15. NOTICE TO PROPERTY OWNERS

Contractor shall provide written notice of work schedule to property owners adjacent to immediate work area. Notice shall include approximate work dates, directions regarding on-street parking, sprinkler system operation, trimming of tree limbs, misc. encroachments, etc. Contractor shall submit sample notice to the Engineer for approval.

16. EQUIPMENT STAGING AREAS

Equipment staging/storage areas shall be approved by the Engineer.

17. TRANSITIONS AND TIE-INS

Contractor shall provide necessary work to accommodate transitions and tie-ins where new work abuts or connects to existing facilities.

18. SPECIALTY SIGNAGE

Appropriate signage shall be provided and maintained by the Contractor, as necessary to provide notification to County staff and/or the public with regard to safety, restricted work zones or changes to pre-existing movement patterns of persons or vehicles.

19. ADJUSTMENTS TO EXISTING UTILITIES WITHIN PAVEMENT

Top elevations of existing utility structures shall be adjusted to match new asphalt elevations in expanded Judges Parking Lots.

20. DEBRIS REMOVAL AND CLEAN UP

Contractor shall remove all debris from roadway and gutter surfaces, as necessary to properly complete the work. Debris shall be disposed of, at a suitable offsite location selected by the Contractor, at no additional cost.

Debris and waste materials generated by the work shall be disposed of by the Contractor at a suitable off-site location.

21. TIME OF WORK

No work shall be done between 6:00 p.m. and 7:00 a.m., nor on Sundays or legal holidays, without the written permission of the Owner. However, maintenance or emergency work during these hours may be done without prior permission.

Overtime Notice: If the Contractor for his convenience and at his own expense should desire to carry on his own work at night or outside regular hours, he shall submit written notice to the Engineer and he shall allow ample time for satisfactory arrangements to be made for inspecting the work in progress. The Engineer will be the sole judge of whether on-site inspection is required. The Contractor will pay the Engineer an amount equal to 3.0 times the direct salary cost of the resident inspector for such work, said amount to be deducted from the payments to the Contractor by the Owner.

BID

Proposal of _____ (hereinafter) called "BIDDER"), organized and existing under the laws of the State of Georgia , doing business as _____*. (ie- Corp,LLC,etc.)

To FAYETTE COUNTY, GEORGIA (hereinafter called "OWNER").

In compliance with your Advertisement for Bids, BIDDER hereby proposes to perform all WORK for the construction of

RENOVATIONS TO JUSTICE CENTER

FOR FAYETTE COUNTY, GEORGIA in strict accordance with the CONTRACT DOCUMENTS, within the time set forth therein, and at the prices stated below.

By submission of this BID, each BIDDER certifies, and in the case of a joint BID each party thereto certifies as to its own organization, that this BID has been arrived at independently, without consultation, communication, or agreement as to any matter relating to this BID with any other BIDDER or with any competitor.

BIDDER hereby agrees to commence WORK under this contract on or before a date to be specified in the NOTICE TO PROCEED and to fully complete the PROJECTS within the time indicated on the Bid Schedule. BIDDER agrees to pay as liquidated damages, the sum of $ 500.00 for each consecutive day thereafter.

BIDDER acknowledges receipt of the following ADDENDUMs:

_____

BIDDER agrees to perform all the work described in the CONTRACT DOCUMENTS for the following unit prices or lump sum:

BID SCHEDULE

NOTES: BIDS shall include labor, materials, subcontracted work, delivery, storage, sales tax and all other incidental work and applicable taxes, insurance, bonds and fees, required for a complete project.

No.	Item	Unit Quant.	Total Unit	Unit Price	Est. Price
1.	Mobilization.	1	L.S.	L.S.	$
2.	Temporary jobsite facilities Including office trailers, storage, Sanitary, construction elevator, Utilities, etc.	1	L.S.	L.S.	$
3.	Sitework, including clearing, grading, demolition, expansion to judges parking lot, storm inlet modifications GAB, paving, striping, curb & gutter, Erosion Control and sod.	1	L.S.	L.S.	$
4.	Modifications to existing Security Fencing at construction elevator and expanded Judges Parking lot.	1	L.S.	L.S.	$
5.	Leak repair at subterranean Tunnel between Jail and Justice Center.	1	L.S.	L.S.	$
6.	Buildout of Justice Center, 3rd Floor, complete including All finishes and systems.	1	L.S.	L.S.	$

7. Renovation of Justice Center, 2nd Floor, complete including All finishes and systems.

1	L.S.	L.S.	$

8. Renovation of Justice Center, 1st Floor, complete including All finishes and systems.

1	L.S.	L.S.	$

9. Site Security Improvements Intended to limit vehicular access and proximity to Justice Center building. (Traffic Bollards and landscape planter box Barriers.)

1	L.S.	L.S.	$

Optional Deduct from bid item #9 for substitute of Landscape Boulders (1000lb minimum) for concrete planter boxes.

<$ >

10. Contingency Allowance.

1	L.S.	L.S.	$250,000.00

Notes:

A. The Owner reserves the right to modify project scope, as necessary to meet project budget limitations, based on prices bid.

B. The Continency Allowance will be included in the Awarded Contract. Charges/Credits against this allowance will be used to account for unforeseen jobsite conditions and/or requested changes in scope and will require approval by the Architect and Project Manager prior to initiating the associated work. Unused portions of the allowance will be credited against the final contract amount at the completion of the project.

C. Furniture, Fixtures and Equipment not specifically called for in the construction plans and specifications are excluded from this project.

D. Base bid shall include equipment by specified manufacturers. Bidder may also provide a deductive alternate manufacturer with the price difference from the base bid equipment for consideration by the Owner.

TOTAL OF BASE BID . . . . . $

Time to Complete Project . . . . . Calendar Days.

Respectfully Submitted:

Signature	Company
Printed Name	Address
Title	
License No.	Date

SEAL - (if BID is by a corporation)

SECTION 011000
SUMMARY

PART 1 GENERAL

1.01 PROJECT

A. Project Name: Renovation of Fayette County Justice Center

B. Owner's Name: Fayette County Board of Commissioners .

C. Architect's Name: IPG Incorporated - Architects & Planners.

D. The Project consists of the renovation and buildout of the existing Fayette County Justice Center which includes 3rd floor buildout, renovations of the 1st and 2nd floors, repair of underground tunnel between jail and Justice Center along with the expansion of an existing secured parking lot. .

1.02 CONTRACT DESCRIPTION

A. Contract Type: A single prime contract based on a Stipulated Price as described in Document 005200 - Agreement Form.

1.03 DESCRIPTION OF ALTERATIONS WORK

A. Scope of demolition and removal work is indicated on drawings and specified in Section 024100.

B. Scope of alterations work is indicated on drawings.

C. Renovate the following areas, complete including operational mechanical and electrical work and finishes:

D. Plumbing: Alter existing system and add new construction, keeping existing in operation.

E. HVAC: Alter existing system and add new construction, keeping existing in operation.

F. Electrical Power and Lighting: Alter existing system and add new construction, keeping existing in operation.

G. Fire Suppression Sprinklers: Alter existing system and add new construction, keeping existing in operation.

H. Fire Alarm: Alter existing system and add new construction, keeping existing in operation.

I. Telephone: Alter existing system and add new construction, keeping existing in operation.

J. Owner will remove the following items before start of work:
   1. Loose fixtures and equipment, movable cabinets, artwork, rugs, furniture, cabinet supplies and personal effects..

1.04 WORK BY OWNER

A. Owner will award a contract for supply and installation of AV Systems and Equipment which at a date to be determined and coordinated with the General Contractor. _____.

1.05 OWNER OCCUPANCY

A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.

B. Owner intends to occupy the Project upon Substantial Completion.

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

D. Schedule the Work to accommodate Owner occupancy.

1.06 CONTRACTOR USE OF SITE AND PREMISES

A. Construction Operations: Limited to areas noted on Drawings.
   1. Locate and conduct construction activities in ways that will limit disturbance to site.

B. Arrange 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 the public.

C. Provide access to and from site as required by law and by Owner:
   1. Emergency Building Exits During Construction: Shall be clearly posted during each Phase of the work..
   2. Do not obstruct roadways, sidewalks, or other public ways without permit.

D. Existing building spaces may be used for storage. If so, this may be on a Phase by Phase basis. Any areas allowed for use shall be

E. Utility Outages and Shutdown:
   1. Prevent accidental disruption of utility services to other facilities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 012500
SUBSTITUTION PROCEDURES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Procedural requirements for proposed substitutions.

1.02 RELATED REQUIREMENTS

A. Section 013000 - Administrative Requirements: Submittal procedures, coordination.

B. Section 016000 - Product Requirements: Fundamental product requirements, product options, delivery, storage, and handling.

1.03 DEFINITIONS

A. Substitutions: Changes from Contract Documents requirements proposed by Contractor to materials, products, assemblies, and equipment.
   1. Substitutions for Cause: Proposed due to changed Project circumstances beyond Contractor's control.
      a. Unavailability.
      b. Regulatory changes.
   2. Substitutions for Convenience: Proposed due to possibility of offering substantial advantage to the Project.
      a. Substitution requests offering advantages solely to the Contractor will not be considered.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

A. A Substitution Request for products, assemblies, materials, and equipment constitutes a representation that the submitter:
   1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product, equipment, assembly, or system.
   2. Agrees to provide the same warranty for the substitution as for the specified product.
   3. Agrees to coordinate installation and make changes to other work that may be required for the work to be complete, with no additional cost to Owner.
   4. Waives claims for additional costs or time extension that may subsequently become apparent.

B. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents. Burden of proof is on proposer.

C. Content: Include information necessary for tracking the status of each Substitution Request, and information necessary to provide an actionable response.

D. Limit each request to a single proposed substitution item.

3.02 RESOLUTION

A. Architect may request additional information and documentation prior to rendering a decision. Provide this data in an expeditious manner.

B. Architect will notify Contractor in writing of decision to accept or reject request.

3.03 ACCEPTANCE

A. Accepted substitutions change the work of the Project. They will be documented and incorporated into work of the project by Change Order, Construction Change Directive, Architectural Supplementary Instructions, or similar instruments provided for in the Conditions of the Contract.

3.04 CLOSEOUT ACTIVITIES

A. See Section 017700 - Closeout procedures, for closeout submittals.

END OF SECTION

SECTION 013000
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General administrative requirements.

B. Preconstruction meeting.

C. Progress meetings.

D. Construction progress schedule.

E. Number of copies of submittals.

F. Requests for Interpretation (RFI) procedures.

G. Submittal procedures.

1.02 GENERAL ADMINISTRATIVE REQUIREMENTS

A. Comply with requirements of Section 017000 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

B. Make the following types of submittals to Architect:
   1. Requests for Interpretation (RFI).
   2. Requests for substitution.
   3. Shop drawings, product data, and samples.
   4. Test and inspection reports.
   5. Design data.
   6. Manufacturer's instructions and field reports.
   7. Applications for payment and change order requests.
   8. Progress schedules.
   9. Coordination drawings.
   10. Correction Punch List and Final Correction Punch List for Substantial Completion.
   11. Closeout submittals.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRECONSTRUCTION MEETING

A. Schedule meeting after Notice of Award.

B. Attendance Required:
   1. Owner.
   2. Architect.
   3. Contractor.

C. Agenda:
   1. Execution of Owner-Contractor Agreement.
   2. Submission of executed bonds and insurance certificates.
   3. Distribution of Contract Documents.
   4. Submission of list of subcontractors, list of products, schedule of values, and progress schedule.
   5. Designation of personnel representing the parties to Contract, _____ and Architect.
   6. Procedures and processing of field decisions, submittals, substitutions, applications for payments, proposal request, Change Orders, and Contract closeout procedures.
   7. Scheduling.

D. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.02 PROGRESS MEETINGS

A. Schedule and administer meetings throughout progress of the work at maximum monthly intervals.

B. Make arrangements for meetings, prepare agenda with copies for participants, preside at meetings.

C. Attendance Required:
   1. Contractor.
   2. Owner.
   3. Architect.
   4. Contractor's superintendent.
   5. Major subcontractors.

D. Agenda:
   1. Review minutes of previous meetings.
   2. Review of work progress.
   3. Field observations, problems, and decisions.
   4. Identification of problems that impede, or will impede, planned progress.
   5. Review of submittals schedule and status of submittals.
   6. Review of RFIs log and status of responses.
   7. Maintenance of progress schedule.
   8. Corrective measures to regain projected schedules.
   9. Planned progress during succeeding work period.
   10. Maintenance of quality and work standards.
   11. Effect of proposed changes on progress schedule and coordination.
   12. Other business relating to work.

E. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.

3.03 CONSTRUCTION PROGRESS SCHEDULE

A. Within 10 days after date of the Agreement, submit preliminary schedule defining planned operations for the first 60 days of work, with a general outline for remainder of work.

B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.

C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
   1. Include written certification that major contractors have reviewed and accepted proposed schedule.

D. Within 10 days after joint review, submit complete schedule.

E. Submit updated schedule with each Application for Payment.

3.04 REQUESTS FOR INTERPRETATION (RFI)

A. Whenever possible, request clarifications at the next appropriate project progress meeting, with response entered into meeting minutes, rendering unnecessary the issuance of a formal RFI.

B. Preparation: Prepare an RFI immediately upon discovery of a need for interpretation of Contract Documents. Failure to submit a RFI in a timely manner is not a legitimate cause for claiming additional costs or delays in execution of the work.
   1. Prepare a separate RFI for each specific item.
      a. Review, coordinate, and comment on requests originating with subcontractors and/or materials suppliers.
      b. Do not forward requests which solely require internal coordination between subcontractors.
   2. Combine RFI and its attachments into a single electronic file. PDF format is preferred.

C. Content: Include identifiers necessary for tracking the status of each RFI, and information necessary to provide an actionable response.
   1. Discrete and consecutive RFI number, and descriptive subject/title.
   2. Issue date, and requested reply date.
   3. Annotations: Field dimensions and/or description of conditions which have engendered the request.
   4. Contractor's suggested resolution: A written and/or a graphic solution, to scale, is required in cases where clarification of coordination issues is involved, for example; routing, clearances, and/or specific locations of work shown diagrammatically in Contract Documents. If applicable, state the likely impact of the suggested resolution on Contract Time or the Contract Sum.

D. RFI Log: Prepare and maintain a tabular log of RFIs for the duration of the project.

E. Review Time: Architect will respond and return RFIs to Contractor within seven calendar days of receipt. For the purpose of establishing the start of the mandated response period, RFIs received after 12:00 noon will be considered as having been received on the following regular working day.
   1. Response period may be shortened or lengthened for specific items, subject to mutual agreement, and recorded in a timely manner in progress meeting minutes.

F. Responses: Content of answered RFIs will not constitute in any manner a directive or authorization to perform extra work or delay the project. If in Contractor's belief it is likely to lead to a change to Contract Sum or Contract Time, promptly issue a notice to this effect, and follow up with an appropriate Change Order request to Owner.
   1. Notify Architect within seven calendar days if an additional or corrected response is required by submitting an amended version of the original RFI, identified as specified above.

3.05 SUBMITTAL SCHEDULE

A. Submit to Architect for review a schedule for submittals in tabular format.
   1. Format schedule to allow tracking of status of submittals throughout duration of construction.
   2. Arrange information to include scheduled date for initial submittal, specification number and title, submittal category (for review or for information), description of item of work covered, and role and name of subcontractor.

3.06 SUBMITTALS FOR REVIEW

A. When the following are specified in individual sections, submit them for review:
   1. Product data.
   2. Shop drawings.
   3. Samples for selection.
   4. Samples for verification.

B. Submit to Architect for review for the limited purpose of checking for compliance with information given and the design concept expressed in Contract Documents.

C. Samples will be reviewed for aesthetic, color, or finish selection.

D. After review, provide copies and distribute in accordance with SUBMITTAL PROCEDURES article below and for record documents purposes described in Section 017800 - Closeout Submittals.

3.07 SUBMITTALS FOR PROJECT CLOSEOUT

A. Submit Correction Punch List for Substantial Completion.

B. Submit Final Correction Punch List for Substantial Completion.

C. When the following are specified in individual sections, submit them at project closeout in compliance with requirements of Section 017800 - Closeout Submittals:
   1. Project record documents.

2. Operation and maintenance data.
3. Warranties.
4. Bonds.
5. Other types as indicated.

D. Submit for Owner's benefit during and after project completion.

3.08 NUMBER OF COPIES OF SUBMITTALS

A. Electronic Documents: Submit one electronic copy in PDF format; an electronically-marked up file will be returned. Create PDFs at native size and right-side up; illegible files will be rejected.

B. Samples: Submit the number specified in individual specification sections; one of which will be retained by Architect.
1. After review, produce duplicates.
2. Retained samples will not be returned to Contractor unless specifically so stated.

3.09 SUBMITTAL PROCEDURES

A. General Requirements:
1. Use a single transmittal for related items.
2. Apply Contractor's stamp, signed or initialed certifying that review, approval, verification of products required, field dimensions, adjacent construction work, and coordination of information is in accordance with the requirements of the work and Contract Documents.
a. Submittals from sources other than the Contractor, or without Contractor's stamp will not be acknowledged, reviewed, or returned.
3. Schedule submittals to expedite the Project, and coordinate submission of related items.
4. Provide space for Contractor and Architect review stamps.
5. When revised for resubmission, identify all changes made since previous submission.

B. Product Data Procedures:
1. Submit only information required by individual specification sections.
2. Collect required information into a single submittal.
3. Do not submit (Material) Safety Data Sheets for materials or products.

C. Shop Drawing Procedures:
1. Prepare accurate, drawn-to-scale, original shop drawing documentation by interpreting Contract Documents and coordinating related work.
2. Do not reproduce Contract Documents to create shop drawings.
3. Generic, non-project-specific information submitted as shop drawings do not meet the requirements for shop drawings.

D. Samples Procedures:
1. Transmit related items together as single package.
2. Identify each item to allow review for applicability in relation to shop drawings showing installation locations.

3.10 SUBMITTAL REVIEW

A. Submittals for Review: Architect will review each submittal, and approve, or take other appropriate action.

B. Submittals for Information: Architect will acknowledge receipt and review. See below for actions to be taken.

C. Architect's actions will be reflected by marking each returned submittal using virtual stamp on electronic submittals.

D. Architect's and consultants' actions on items submitted for review:
1. Authorizing purchasing, fabrication, delivery, and installation:
a. "Approved", or language with same legal meaning.
b. "Approved as Noted, Resubmission not required", or language with same legal meaning.

1) At Contractor's option, submit corrected item, with review notations acknowledged and incorporated.

c. "Approved as Noted, Resubmit for Record", or language with same legal meaning.

2. Not Authorizing fabrication, delivery, and installation:

E. Architect's and consultants' actions on items submitted for information:

1. Items for which no action was taken:
   a. "Received" - to notify the Contractor that the submittal has been received for record only.
2. Items for which action was taken:
   a. "Reviewed" - no further action is required from Contractor.

END OF SECTION

SECTION 014000
QUALITY REQUIREMENTS

PART 1 - GENERAL

1.1 CONFLICTING REQUIREMENTS

A. General: If compliance with two or more standards is specified and the standards establish different or conflicting requirements for minimum quantities or quality levels, comply with the most stringent requirement. Refer uncertainties and requirements that are different, but apparently equal, to Design Professional for a decision before proceeding.

B. Minimum Quantity or Quality Levels: The quantity or quality level shown or specified shall be the minimum provided or performed. The actual installation may comply exactly with the minimum quantity or quality specified, or it may exceed the minimum within reasonable limits. To comply with these requirements, indicated numeric values are minimum or maximum, as appropriate, for the context of requirements. Refer uncertainties to Design Professional for a decision before proceeding.

1.2 SUBMITTALS

A. Qualification Data: For testing agencies to demonstrate their capabilities and experience, include proof of qualifications in the form of a recent report on the inspection of the testing agency by a recognized authority.

B. Reports: Prepare and submit certified written reports that include the following:

1. Date of issue.
2. Project title and number.
3. Name, address, and telephone number of testing agency.
4. Dates and locations of samples and tests or inspections.
5. Names of individuals making tests and inspections.
6. Description of the Work and test and inspection method.
7. Identification of product and Specification Section.
8. Complete test or inspection data.
9. Test and inspection results and an interpretation of test results.
10. Record of temperature and weather conditions at time of sample taking and testing and inspecting.
11. Comments or professional opinion on whether tested or inspected Work complies with the Contract Document requirements.
12. Name and signature of laboratory inspector.
13. Recommendations on retesting and reinspecting.

C. Permits, Licenses, and Certificates: For Owner's records, submit copies of permits, licenses, certifications, inspection reports, releases, jurisdictional settlements, notices, receipts for fee payments, judgments, correspondence, records, and similar documents, established for compliance with standards and regulations bearing on performance of the Work.

1.3 QUALITY ASSURANCE

A. General: Qualifications paragraphs in this Article establish the minimum qualification levels required; individual Specification Sections specify additional requirements.

B. Installer Qualifications: A firm or individual experienced in installing, erecting, or assembling work similar in material, design, and extent to that indicated for this Project, whose work has resulted in construction with a record of successful in-service performance.

C. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

D. Fabricator Qualifications: A firm experienced in producing products similar to those indicated for this Project and with a record of successful in-service performance, as well as sufficient production capacity to produce required units.

E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in jurisdiction where Project is located and who is experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or products that are similar to those indicated for this Project in material, design, and extent.

F. Specialists: Certain sections of the Specifications require that specific construction activities shall be performed by entities who are recognized experts in those operations. Specialists shall satisfy qualification requirements indicated and shall be engaged for the activities indicated.

1. Requirement for specialists shall not supersede building codes and regulations governing the Work.

G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated; and with additional qualifications specified in individual Sections that is acceptable to Design Professional.

1. NRTL: A nationally recognized testing laboratory according to 29 1910.7.
2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.

H. Factory-Authorized Service, Manufacturer’s Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products that are similar in material, design, and extent to those indicated for this Project.

I. Mockups: Before installing portions of the Work requiring mockups, build mockups for each form of construction and finish required to comply with the following requirements, using materials indicated for the completed Work:

1. Build mockups in location and of size indicated or, if not indicated, as directed by Design Professional.
2. Demonstrate the proposed range of aesthetic effects and workmanship.
3. Build integrated mockups where possible consisting of related components and systems, i.e. exterior wall systems with framing members, substrates, flashings, masonry veneer with veneer ties and weep holes, window openings with frame, and other components.
4. Obtain Design Professional's approval of mockups before starting work, fabrication, or

construction.
5. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
6. Demolish and remove mockups when directed, unless otherwise indicated.

1.4 QUALITY CONTROL

A. Owner Responsibilities: Where quality-control services are indicated as Owner's responsibility, Design Professional will engage a qualified testing agency to perform these services.

1. Design Professional will furnish Contractor with names, addresses, and telephone numbers of testing agencies engaged and a description of types of testing and inspecting they are engaged to perform. Payment for these services will be made from a testing and inspecting account through the Owner.
2. Costs for retesting and reinspecting construction that replaces or is necessitated by work that failed to comply with the Contract Documents will be charged to Contractor.

B. Preconstruction tests and inspections for materials to meet requirements are the Contractor’s responsibility.

1. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform these quality-control services.
2. Where quality-control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality-control service.
3. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.

C. Manufacturer's Field Services: Where indicated, engage a factory-authorized service representative to inspect field-assembled components and equipment installation, including service connections.

D. Retesting/Reinspecting: Regardless of whether original tests or inspections were Contractor's responsibility, provide quality-control services, including retesting and reinspecting, for construction that replaced Work that failed to comply with the Contract Documents.

E. Testing Agency Responsibilities: Cooperate with Design Professional and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.

1. Notify Design Professional and Contractor promptly of irregularities or deficiencies observed in the Work during performance of its services.
2. Determine the location from which test samples will be taken and in which in-situ tests are conducted.
3. Conduct and interpret tests and inspections and state in each report whether tested and inspected work complies with or deviates from requirements.
4. Submit a certified written report, in duplicate, of each test, inspection, and similar quality-control service through Contractor.
5. Does not release, revoke, alter, or increase the Contract Document requirements or approve or accept any portion of the Work.
6. Do not perform any duties of Contractor.

F. Associated Services: Cooperate with agencies performing required tests, inspections, observations, and similar quality-control services, and provide reasonable auxiliary services as requested. Notify agency sufficiently in advance of operations to permit assignment of

personnel. Provide the following:

1. Access to the Work.
2. Incidental labor and facilities necessary to facilitate tests and inspections.
3. Adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
4. Facilities for storage and field curing of test samples.
5. Preliminary design mix proposed for use for material mixes that require control by testing agency.
6. Security and protection for samples and for testing and inspecting equipment at Project site.

G. Coordination: Coordinate sequence of activities to accommodate required quality-assurance and -control services with a minimum of delay and to avoid necessity of removing and replacing construction to accommodate testing and inspecting.

1. Schedule times for tests, inspections, obtaining samples, and similar activities and notify Design Professional and Building Envelope Commissioning Agency.

1.5 SPECIAL TESTS INSPECTIONS

A. Special Tests and Inspections: Design Professional will engage a qualified testing agency to conduct special tests and inspections as follows:

1. Verifying that manufacturer maintains detailed fabrication and quality-control procedures and reviewing the completeness and adequacy of those procedures to perform the Work.
2. Notifying Design Professional and Contractor promptly of irregularities and deficiencies observed in the Work during performance of its services.
3. Submitting a certified written report of each test, inspection, and similar quality-control service to Design Professional with copy to Contractor and to Owner.
4. Submitting a final report of special tests and inspections at Material Completion, which shall include a list of unresolved deficiencies.
5. Interpreting tests and inspections and stating in each report whether tested and inspected work complies with or deviates from the Contract Documents.
6. Retesting and reinspecting corrected work.

B. Statement of Special Inspections, Schedule of Special Inspections and the Fabricator’s Certificate of Compliance follows this section.

PART 2 - PRODUCTS (Not Used)
PART 3 - EXECUTION

3.1 TEST AND INSPECTION LOG

A. Prepare a record of tests and inspections. Include the following:

1. Date test or inspection was conducted.
2. Description of the work tested or inspected.
3. Date test or inspection results were transmitted to Design Professional.
4. Identification of testing agency or special inspector conducting test or inspection.

B. Maintain log at Project site. Post changes and modifications as they occur. Provide access to test and inspection log for Design Professional’s reference during normal working hours.

3.2 REPAIR PROTECTION

A. General: On completion of testing, inspecting, sample taking, and similar services, repair damaged construction and restore substrates and finishes.

1. Provide materials and comply with installation requirements specified in other Specification Sections. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible.

B. Protect construction exposed by or for quality-control service activities.

C. Repair and protection are Contractor's responsibility, regardless of the assignment of responsibility for quality-control services.

END OF SECTION 014000

SECTION 015000
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary utilities.

B. Temporary sanitary facilities.

C. Temporary Controls: Barriers, enclosures, and fencing.

D. Security requirements.

E. Waste removal facilities and services.

1.02 RELATED REQUIREMENTS

A. Section 015100 - Temporary Utilities.

1.03 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

1.04 TEMPORARY UTILITIES - SEE SECTION 015100

A. Provide and pay for all electrical power, lighting, water, heating and cooling, and ventilation required for construction purposes.

1.05 TEMPORARY SANITARY FACILITIES

A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.

B. Use of existing facilities not permitted.

C. Maintain daily in clean and sanitary condition.

D. At end of construction, return facilities to same or better condition as originally found.

1.06 BARRIERS

A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.

B. Provide barricades and covered walkways required by governing authorities for public rights-of-way and for public access to existing building.

C. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 FENCING

A. Construction: Commercial grade chain link fence.

B. Provide 6 foot (1.8 m) high fence, fence visual screen, around construction site entry; equip with vehicular and pedestrian gates with locks.

1.08 INTERIOR ENCLOSURES

A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.

B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
   1. STC rating of 35 in accordance with ASTM E90.
   2. Maximum flame spread rating of 75 in accordance with ASTM E84.

C. Paint surfaces exposed to view from Owner-occupied areas.

1.09 SECURITY - SEE SECTION 013553

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

B. Coordinate with Owner's security program.

1.10 VEHICULAR ACCESS AND PARKING - SEE SECTION 015500

A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.

B. Coordinate access and haul routes with governing authorities and Owner.

C. Provide and maintain access to fire hydrants, free of obstructions.

D. Provide means of removing mud from vehicle wheels before entering streets.

E. Designated existing on-site roads may be used for construction traffic.

F. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.

G. Existing parking areas may be used for construction parking. See A0.00 Architectural Site Plan for location.

1.11 WASTE REMOVAL

A. See Section 017419 - Construction Waste Management and Disposal, for additional requirements.

B. Provide waste removal facilities and services as required to maintain the site in clean and orderly condition.

C. Provide containers with lids. Remove trash from site periodically.

D. If materials to be recycled or re-used on the project must be stored on-site, provide suitable non-combustible containers; locate containers holding flammable material outside the structure unless otherwise approved by the authorities having jurisdiction.

E. Open free-fall chutes are not permitted. Terminate closed chutes into appropriate containers with lids.

1.12 FIELD OFFICES - SEE SECTION 015213

A. Office: Weathertight, with lighting, electrical outlets, heating, cooling equipment, and equipped with sturdy furniture, drawing rack, and drawing display table.

B. Provide space for Project meetings, with table and chairs to accommodate 6 persons.

C. Locate offices a minimum distance of 30 feet (10 m) from existing and new structures.

1.13 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.

B. Remove underground installations to a minimum depth of 2 feet (600 mm). Grade site as indicated.

C. Clean and repair damage caused by installation or use of temporary work.

D. Restore existing facilities used during construction to original condition.

E. Restore new permanent facilities used during construction to specified condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 015100
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Temporary Utilities: Provision of electricity, lighting, heat, ventilation, and water.

1.02 RELATED REQUIREMENTS

A. Section 015000 - Temporary Facilities and Controls:
   1. Temporary sanitary facilities required by law.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

1.04 TEMPORARY ELECTRICITY

A. Cost: By Contractor.

B. Provide temporary electric feeder from existing building electrical service at location as directed.

C. Power Service Characteristics: ____ volt, ____ ampere, three phase, four wire.

D. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.

E. Provide main service disconnect and over-current protection at convenient location and meter.

F. Permanent convenience receptacles may be utilized during construction.

G. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.05 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

A. Provide and maintain LED, compact fluorescent, or high-intensity discharge lighting as suitable for the application for construction operations in accordance with requirements of 29 CFR 1926 and authorities having jurisdiction.

B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.

C. Maintain lighting and provide routine repairs.

1.06 TEMPORARY HEATING

A. Provide heating devices and heat as needed to maintain specified conditions for construction operations.

B. Maintain minimum ambient temperature of 50 degrees F (10 degrees C) in areas where construction is in progress, unless indicated otherwise in specifications.

1.07 TEMPORARY VENTILATION

A. Existing ventilation equipment may not be used.

1.08 TEMPORARY WATER SERVICE

A. Cost of Water Used: By Contractor.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 016000
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. General product requirements.

B. Re-use of existing products.

C. Transportation, handling, storage and protection.

D. Product option requirements.

E. Substitution limitations.

F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

A. Section 012500 - Substitution Procedures: Substitutions made during procurement and/or construction phases.

1.03 SUBMITTALS

A. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.

B. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

C. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
   1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.

PART 2 PRODUCTS

2.01 EXISTING PRODUCTS

A. Do not use materials and equipment removed from existing premises unless specifically required or permitted by Contract Documents.

B. Unforeseen historic items encountered remain the property of the Owner; notify Owner promptly upon discovery; protect, remove, handle, and store as directed by Owner.

C. Existing materials and equipment indicated to be removed, but not to be re-used, relocated, reinstalled, delivered to the Owner, or otherwise indicated as to remain the property of the Owner, become the property of the Contractor; remove from site.

2.02 NEW PRODUCTS

A. Provide new products unless specifically required or permitted by Contract Documents.

B. Use of products having any of the following characteristics is not permitted:
   1. Containing lead, cadmium, or asbestos.

C. Where other criteria are met, Contractor shall give preference to products that:
   1. If used on interior, have lower emissions, as defined in Section 016116.
   2. If wet-applied, have lower VOC content, as defined in Section 016116.

2.03 PRODUCT OPTIONS

A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.

B. Products Specified by Naming One or More Manufacturers: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.

C. Products Specified by Naming One or More Manufacturers with a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.

2.04 MAINTENANCE MATERIALS

A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.

B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION LIMITATIONS

A. See Section 012500 - Substitution Procedures.

3.02 TRANSPORTATION AND HANDLING

A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.

B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.

C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.

D. Transport and handle products in accordance with manufacturer's instructions.

E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.

F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.

G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.

H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.03 STORAGE AND PROTECTION

A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication. See Section 017419.

B. Store and protect products in accordance with manufacturers' instructions.

C. Store with seals and labels intact and legible.

D. Store sensitive products in weathertight, climate-controlled enclosures in an environment favorable to product.

E. For exterior storage of fabricated products, place on sloped supports above ground.

F. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.

G. Comply with manufacturer's warranty conditions, if any.

H. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.

I. Prevent contact with material that may cause corrosion, discoloration, or staining.

J. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.

K. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 017700
CLOSEOUT PROCEDURES

PART 1 - GENERAL

1.1 SUMMARY

A. Section includes administrative and procedural requirements for contract closeout, including, but not limited to, the following:

1. Material Completion procedures.
2. Final completion procedures.
3. Warranties.
4. Final cleaning.
5. Repair of the Work.

1.2 SUBMITTALS

A. Product Data: For cleaning agents.

B. Contractor's List of Incomplete Items: Initial submittal at Material Completion.

C. Certified List of Incomplete Items: Final submittal at Final Completion.

1.3 CLOSEOUT SUBMITTALS

A. Certificates of Release: From Design Professional.

B. Certificate of Insurance: For continuing coverage.

C. Field Report: For pest control inspection.

1.4 MAINTENANCE MATERIAL SUBMITTALS

A. Schedule of Maintenance Material Items: For maintenance material submittal items specified in other Sections.

1.5 MATERIAL COMPLETION PROCEDURES

A. Contractor's List of Incomplete Items: Prepare and submit a list of items to be completed and corrected (Contractor's punch list), indicating the value of each item on the list and reasons why the Work is incomplete.

B. Submittals Prior to Material Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Material Completion. List items below that are incomplete at time of request.

1. Certificates of Release: Obtain and submit releases from Design Professional permitting

Owner unrestricted use of the Work and access to services and utilities. Include occupancy permits, operating certificates, and similar releases.

2. Submit closeout submittals specified in other Division 01 Sections, including project record documents, operation and maintenance manuals, final completion construction photographic documentation, damage or settlement surveys, property surveys, and similar final record information.
3. Submit closeout submittals specified in individual Sections, including specific warranties, workmanship bonds, maintenance service agreements, final certifications, and similar documents.
4. Submit maintenance material submittals specified in individual Sections, including tools, spare parts, extra materials, and similar items, and deliver to location designated by Architect. Label with manufacturer's name and model number where applicable.

    a. Schedule of Maintenance Material Items: Prepare and submit schedule of maintenance material submittal items, including name and quantity of each item and name and number of related Specification Section. Obtain Using Agency’s signature for receipt of submittals.

5. Submit test/adjust/balance records.
6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.

C. Procedures Prior to Material Completion: Complete the following a minimum of 10 days prior to requesting inspection for determining date of Material Completion. List items below that are incomplete at time of request.

1. Advise Owner of pending insurance changeover requirements.
2. Make final changeover of permanent locks and deliver keys to Owner. Advise Owner's personnel of changeover in security provisions.
3. Complete startup and testing of systems and equipment.
4. Perform preventive maintenance on equipment used prior to Material Completion.
5. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems. Submit demonstration and training video recordings specified in Section 017900 "Demonstration and Training."
6. Advise Owner of changeover in heat and other utilities.
7. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
8. Terminate and remove temporary facilities from Project site, along with mockups, construction tools, and similar elements.
9. Complete final cleaning requirements, including touchup painting.
10. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.

D. Inspection: Submit a written request for inspection to determine Material Completion a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare the Certificate of Material Completion after inspection or will notify Contractor of items, either on Contractor's list or additional items identified by Architect, that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.
2. Results of completed inspection will form the basis of requirements for final completion.

1.6 FINAL COMPLETION PROCEDURES

A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:

1. Submit a final Application for Payment according to Section 012900 "Payment Procedures."
2. Certified List of Incomplete Items: Submit certified copy of Architect's Material Completion inspection list of items to be completed or corrected (punch list), endorsed and dated by Architect. Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
3. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
4. Submit pest-control final inspection report.

B. Inspection: Submit a written request for final inspection to determine acceptance a minimum of 10 days prior to date the work will be completed and ready for final inspection and tests. On receipt of request, Architect will either proceed with inspection or notify Contractor of unfulfilled requirements. Architect will prepare a final Certificate for Payment after inspection or will notify Contractor of construction that must be completed or corrected before certificate will be issued.

1. Reinspection: Request reinspection when the Work identified in previous inspections as incomplete is completed or corrected.

1.7 LIST OF INCOMPLETE ITEMS (PUNCH LIST)

A. Organization of List: Include name and identification of each space and area affected by construction operations for incomplete items and items needing correction including, if necessary, areas disturbed by Contractor that are outside the limits of construction.

1. Organize list of spaces in sequential order, starting with exterior areas first and proceeding from lowest floor to highest floor in sequence of room numbers indicated on plans.
2. Organize items applying to each space by major element, including categories for ceiling, individual walls, floors, equipment, and building systems.
3. Include the following information at the top of each page:

a. Project name.
b. Date.
c. Name of Architect.
d. Name of Contractor.
e. Page number.

4. Submit list of incomplete items as required through e-Builder.

1.8 SUBMITTAL OF PROJECT WARRANTIES

A. Time of Submittal: Submit written warranties on request of Architect for designated portions of the Work where commencement of warranties other than date of Material Completion is indicated, or when delay in submittal of warranties might limit Owner's rights under warranty.

B. Organize warranty documents into an orderly sequence based on the table of contents of

Project Manual.

1. Bind warranties and bonds in heavy-duty, three-ring, vinyl-covered, loose-leaf binders, thickness as necessary to accommodate contents, and sized to receive **8-1/2-by-11-inch** paper.
2. Provide heavy paper dividers with plastic-covered tabs for each separate warranty. Mark tab to identify the product or installation. Provide a typed description of the product or installation, including the name of the product and the name, address, and telephone number of Installer.
3. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
4. Warranty Electronic File: Scan warranties and bonds and assemble complete warranty and bond submittal package into a single indexed electronic PDF file with links enabling navigation to each item. Provide bookmarked table of contents at beginning of document.

C. Provide additional copies of each warranty to include in operation and maintenance manuals.

D. Provide all required hard copy information as required in the Construction Contract.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 FINAL CLEANING

A. General: Perform final cleaning. Conduct cleaning and waste-removal operations to comply with local laws and ordinances and Federal and local environmental and antipollution regulations.

B. Cleaning: Employ experienced workers or professional cleaners for final cleaning. Clean each surface or unit to condition expected in an average commercial building cleaning and maintenance program. Comply with manufacturer's written instructions.

1. Complete the following cleaning operations before requesting inspection for certification of Material Completion for entire Project or for a designated portion of Project:

a. Clean Project site, yard, and grounds, in areas disturbed by construction activities, including landscape development areas, of rubbish, waste material, litter, and other foreign substances.
b. Sweep paved areas broom clean. Remove petrochemical spills, stains, and other foreign deposits.
c. Rake grounds that are neither planted nor paved to a smooth, even-textured surface.
d. Remove tools, construction equipment, machinery, and surplus material from Project site.
e. Clean exposed exterior and interior hard-surfaced finishes to a dirt-free condition, free of stains, films, and similar foreign substances. Avoid disturbing natural weathering of exterior surfaces. Restore reflective surfaces to their original condition.
f. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
g. Sweep concrete floors broom clean in unoccupied spaces.
h. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean

according to manufacturer's recommendations if visible soil or stains remain.

i. Clean transparent materials, including mirrors and glass in doors and windows. Remove glazing compounds and other noticeable, vision-obscuring materials. Polish mirrors and glass, taking care not to scratch surfaces.
j. Remove labels that are not permanent.
k. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
l. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.
m. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
n. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.

1) Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.

o. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
p. Leave Project clean and ready for occupancy.

C. Pest Control: Comply with pest control requirements in Section 015000 "Temporary Facilities and Controls." Prepare written report.

D. Construction Waste Disposal: Comply with waste disposal requirements in Section 015000 "Temporary Facilities and Controls."

3.2 REPAIR OF THE WORK

A. Complete repair and restoration operations before requesting inspection for determination of Material Completion.

B. Repair or remove and replace defective construction. Repairing includes replacing defective parts, refinishing damaged surfaces, touching up with matching materials, and properly adjusting operating equipment. Where damaged or worn items cannot be repaired or restored, provide replacements. Remove and replace operating components that cannot be repaired. Restore damaged construction and permanent facilities used during construction to specified condition.

1. Remove and replace chipped, scratched, and broken glass, reflective surfaces, and other damaged transparent materials.
2. Touch up and otherwise repair and restore marred or exposed finishes and surfaces. Replace finishes and surfaces that that already show evidence of repair or restoration.

a. Do not paint over "UL" and other required labels and identification, including mechanical and electrical nameplates. Remove paint applied to required labels and identification.

3. Replace parts subject to operating conditions during construction that may impede operation or reduce longevity.
4. Replace burned-out bulbs, bulbs noticeably dimmed by hours of use, and defective and noisy starters in fluorescent and mercury vapor fixtures to comply with requirements for new fixtures.

END OF SECTION 017700

SECTION 020342
REMOVAL AND SALVAGE OF PERIOD CONSTRUCTION MATERIALS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Specified procedures required for preservation, rehabilitation, restoration, and reconstruction treatment areas.

1.02 RELATED REQUIREMENTS

A. Section 011000 - Summary: Contract descriptions, description of nonhistoric preservation alterations work, work by others, future work, occupancy conditions, use of site and premises, work sequence.

B. Section 024100 - Demolition: Selective demolition of nonhistoric, built site elements.

C. Section 024100 - Demolition: Selective demolition of nonhistoric building elements for alteration purposes.

1.03 REFERENCE STANDARDS

A. 29 CFR 1926 - Safety and Health Regulations for Construction; Current Edition.

B. ASTM E336 - Standard Test Method for Measurement of Airborne Sound Attenuation Between Rooms in Buildings; 2023.

C. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2022, with Errata (2021).

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 PERIOD TREATMENT, GENERAL

A. See Section 013591 for special procedure requirements related to elements and features of historical significance and value.

3.02 GENERAL PROCEDURES

A. Drawings indicating existing construction, building services, and site utilities are based on casual field observation and existing record documents only.
   1. Report discrepancies to Architect before disturbing existing elements.
   2. Beginning of work constitutes acceptance of existing conditions that are apparent upon examination at that time.

B. Separate spaces in which removals and salvage operations are conducted from occupied spaces.
   1. Provide, erect, and maintain temporary dustproof partitions; see Section 015000.
   2. Provide sound retardant temporary partitions in locations indicated on drawings.
      a. Construct sound retardant temporary partitions with two layers of 5/8-inch (16 mm) gypsum wallboard on each side and cavities fully filled with sound batts.

C. Maintain weatherproof exterior building enclosure except for interruptions required for replacement or modifications; exercise care to prevent water and humidity damage.

D. See Section 024100 for selective demolition of nonhistoric elements.

3.03 ENVIRONMENTAL CONTROLS

A. Comply with federal, state, and local regulations pertaining to water, air, solid waste, recycling, chemical waste, sanitary waste, sediment, and noise pollution.

3.04 ITEMS TO BE SALVAGED

A. General: Salvage elements and components to the maximum extent possible. Maintain a chain of custody of salvaged materials, including the condition of such materials before and after salvage operations.

1. Accomplish removal of salvageable items by hand labor to the maximum extent possible.
2. Take care not to damage portions of the structure scheduled to remain or items identified for salvage.
3. Obtain hot work permits for removal of elements requiring use of fire- or spark-producing tools or activities that produce sources of ignition.

B. Metal Elements: Remove intact and salvage metal elements indicated on drawings.

C. Wood Elements: Remove intact and salvage wood elements indicated on drawings.

D. Thermal and Moisture Protection Elements: Remove intact and salvage thermal and moisture protection elements indicated on drawings.

E. Doors and Windows: Remove intact and salvage doors and windows indicated on drawings.

F. Finishes: Protect finishes and finish elements indicated on drawings.

G. Equipment and Specialty Elements: Remove intact and salvage specialty elements indicated on drawings.

H. Mechanical Equipment: Remove intact and salvage equipment and fixtures indicated on drawings.

I. Electrical Equipment: Remove intact and salvage equipment and fixtures indicated on drawings.

3.05 MATERIALS TO BE REMOVED

A. Remove existing elements as indicated and as required to allow direct access to construction elements indicated to be restored or salvaged for reuse.
   1. Remove items indicated on drawings.

B. Services: Remove existing systems and equipment to extent indicated, including but not limited to Fire Protection, Plumbing, HVAC, Electrical, and Telecommunications elements:
   1. Maintain existing active systems that are to remain in operation; maintain access to equipment and other operational components.
   2. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service switchover.
   3. Verify that abandoned services serve only abandoned facilities prior to commencing removals.
   4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stubs and tag with identification.

C. Protect existing elements.
   1.
   2. Perform cutting to accomplish removals neatly, minimizing overcutting.

3.06 MATERIALS TO BE RECYCLED

A. Recycle removed nonhistoric materials to the maximum extent possible. Remove recyclable materials by hand wherever possible.

B. Recycle items indicated on drawings.

3.07 CLEANING

A. Upon completion of work, clean dust, dirt, and debris caused by salvage and demolition operations from portions of existing structure to remain and adjacent areas. Remove and transport debris and rubbish in a manner that prevents spillage on streets or adjacent areas. Obey local regulations regarding hauling and disposal.

END OF SECTION

SECTION 02 41 00
DEMOLITION, CLEARING, AND GRUBBING

PART 1 – GENERAL

1.1 DESCRIPTION

A. Work included: Demolition, clearing, and grubbing required for this Work may include but is not necessarily limited to:

1. Removal of concrete and removal of asphaltic concrete pavement.
2. Felling of trees and removal of stumps, roots, tree debris, and other vegetation designated for removal. Trimming of trees to remain.
3. Demolition and removal of buildings where noted on Plans.
4. Removal of all debris.
5. Constructing necessary barriers and barricades where required.

B. Related Work described elsewhere:

1. Earthwork: Section 31 20 00.

C. Definitions:

1. The term "demolition, clearing, and grubbing," as used herein, includes the removal of all existing objects (except for those objects designated to remain) down to the existing ground level, plus such other work as is described in this Section of these Specifications.
2. The term "clearing" shall consist of the felling, cutting up, and satisfactory disposal of all trees, bushes, shrubs, vegetation, and debris occurring within the area to be cleared.
3. The term "grubbing" shall consist of the removal and disposal of all stumps, roots larger than two (2) inches in diameter to the depth specified, and matted roots from the designated grubbing areas.

1.2 QUALITY ASSURANCE

A. Qualification of workmen: Provide at least one person who shall be present at all times during the demolition, clearing and grubbing operations, and who shall be thoroughly familiar with the Work involved and who shall direct the Work.

B. Codes and Standards:

1. Conform to all Federal, State and local laws and regulations.
2. In addition to complying with all pertinent codes and regulations, comply with the requirements of those insurance carriers providing coverage for this Work.

1.3 JOB CONDITIONS

A. Scheduling:

1. The **Design Professional** reserves the right to direct the order of the Work as may be in the best interest of the Owner.

B. Protection:

1. Provide adequate facilities for protecting all structures, buildings, and utilities

underground, on the surface, or above ground against all construction activity. In the event of damage, immediately make all repairs and replacements necessary to the approval of the **Design Professional** at no additional cost to the Owner.

2. Streets and Highways:
   a. Provide, erect, and maintain effective barricades, danger signals, and signs on all intercepted streets or highways and in other locations where required for the protection of the Work and the safety of the public.
   b. Provide with lights, barricades or obstructions which encroach on, or are adjacent to public rights-of-way. Keep lights burning at all times between sunset and sunrise.
3. Traffic and Services:
   a. Arrange Work to cause a minimum of disturbance to normal pedestrian and vehicular traffic.
   b. Provide adequate means of access to all public and private properties during all stages of construction.

PART 2 – PRODUCTS

2.1 FILL MATERIAL

A. Where fill is required, all fill dirt shall be free from vegetation and debris and shall be obtained from a site approved by the **Design Professional**.

2.2 OTHER MATERIALS

A. All other materials not specifically described, but required, for proper completion of the work of this Section shall be as selected by the Contractor subject to approval of the **Design Professional**.

PART 3 – EXECUTION

3.1 PREPARATION

A. Notification: Notify the **Design Professional** at least one full working day prior to commencing the Work of this Section.

B. Site inspection:

1. Prior to all Work of this Section, carefully inspect the entire site and all objects designated to be removed and to be preserved.
2. Locate all existing utility lines and determine all requirements for disconnecting and capping the lines which are to be abandoned.
3. Locate all existing utility lines traversing the site and determine the requirements for the protection of those lines which are to remain.

C. Clarification:

1. The Drawings do not purport to show all objects existing on the site.
2. Before commencing the Work of this Section, verify with the **Design Professional** all objects to be removed and all objects to be preserved.

D. Scheduling:

1. Schedule all Work in a careful manner with all necessary consideration for

neighbors and the public.

2. Avoid interference with the use of, and passage to and from, adjacent buildings and facilities.

E. Disconnection of utilities: Before starting site operation, disconnect or arrange for the disconnection of all utility services designated to be removed, performing all such Work in accordance with the requirements of the utility company or agency involved.

F. Protection of utilities: Preserve in operating condition all active utilities which transverse the site and designated to remain.

G. Limits of construction: Demolition, clearing and grubbing shall be performed over the total right-of-way of all newly proposed streets and alleys unless otherwise noted on the plans. Additional areas shall be as noted on the plans and as required for construction of the project including space for control stakes and hubs.

3.2 DEMOLITION OF STRUCTURES

A. Demolish all buildings designated for demolition, pulling out all foundations, basement walls, and concrete slabs; remove all existing asphaltic concrete pavement designated to be removed.

3.3 OTHER DEMOLITION

A. Pull out all existing septic tanks and fuel lines, utility lines designated for abandonment, irrigation and leaching lines, and all other objects designated to be removed. Removal of all facilities shall conform to all existing local, State and Federal regulations.

3.4 CLEARING

A. Remove all rubbish, vines and undergrowth to ground level or below and all other obstructions resting on or protruding through the surface of the existing ground. Trees or shrubs which are to remain in place shall be trimmed and shall be carefully protected from injury or defacement. All limbs and branches required to be trimmed shall be neatly cut close to the trunk of the tree or to main branches, and cuts more than one and one-half (1 1/2) inches in diameter shall be painted with an approved pruning paint in strict accordance with manufacturer's recommendations. All trimming shall be in accordance with the "Standard Pruning Guidelines" for the local authority.

3.5 GRUBBING

A. Stumps, roots, logs or other timber more than two (2) inches in diameter, matted roots and other debris shall be excavated and removed to a depth not less than eighteen (18) inches below the surface of any subgrade, shoulder or slope. All depressions excavated below the original ground surface shall be refilled with suitable material and compacted to make the surface conform to the surrounding ground surface.

3.6 PAVEMENT REMOVAL AND REPLACEMENT

A. Removal:

1. Cut and remove all concrete and asphalt sidewalk and street paving along straight lines.
2. Width: Limit to required width of excavation.

B. Replacement:

1. Repair or replace all concrete and asphalt sidewalk and street paving removed, disturbed or destroyed by construction activity of this project.
2. Use methods and materials required to provide finished sidewalk or paving equal to existing in all respects including finish texture.
3. Place base material for paving over excavations in streets or highways upon completion of backfilling and then open thoroughfare to traffic.
4. Maintain surface of excavation in smooth riding condition until wearing surface is placed.
5. Place wearing surface when directed by Design Professional.

3.7 BLASTING

A. None allowed.

3.8 DISPOSAL

A. Removal of debris: Remove all debris from the site and leave the site in a neat and orderly condition to the approval of the **Design Professional**.

B. Burning: If Contractor desires to burn materials, he shall obtain approval of the local contacts and take all precautions necessary to prevent the spread of fire to areas not to be cleared or to prevent damage to trees to be left in place. Burning shall be done only at approved locations and in conformity with the regulations of the local contacts. The Contractor shall obtain and pay for any and all permits required therefore, and be responsible for proper coordination with the officials having jurisdiction in this matter. Within the City limits only pit burning with an air curtain destructor will be allowed. This activity may take place only with the prior knowledge of the local contacts.

3.9 METHOD OF MEASUREMENT

A. Acre measurement: The number of acres shall be determined by the horizontal measurement of the acres designated on the plans, or as approved by the **Design Professional.**

B. Diameter of tree: The diameter of a tree shall be considered its diameter four and one-half (4 1/2) feet above the ground.

END OF SECTION 02 41 00

SECTION 042600
SINGLE-WYTHE UNIT MASONRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Concrete masonry units.

B. Pre-faced unit masonry.

C. Reinforcement, anchorage, and accessories.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing control and expansion joints.

1.03 REFERENCE STANDARDS

A. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2022.

B. ASTM A641/A641M - Standard Specification for Zinc-Coated (Galvanized) Carbon Steel Wire; 2019.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2022.

E. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2022.

F. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2023.

G. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2023.

H. ASTM C744 - Standard Specification for Prefaced Concrete and Calcium Silicate Masonry Units; 2021.

I. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2022, with Errata (2024).

J. UL (FRD) - Fire Resistance Directory; Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene one week before starting work of this section.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

1.06 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

1.07 MOCK-UP

A. Construct a masonry wall as a mock-up panel sized 8 feet (2.4 m) long by 6 feet (1.8 m) high; include mortar and accessories in mock-up.

B. Mock-up may remain as part of the Work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver, handle, and store masonry units by means that will prevent mechanical damage and contamination by other materials.

1.09 FIELD CONDITIONS

A. Maintain materials and surrounding air temperature to minimum 40 degrees F (5 degrees C) prior to, during, and 48 hours after completion of masonry work.

B. Maintain materials and surrounding air temperature to maximum 90 degrees F (32 degrees C) prior to, during, and 48 hours after completion of masonry work.

PART 2 PRODUCTS

2.01 CONCRETE MASONRY UNITS

A. Concrete Block: Comply with referenced standards and as follows:
   1. Regulatory Requirements: Comply with applicable code for indicated requirements for fire rated masonry construction.
   2. Size: Standard units with nominal face dimensions of 16 x 8 inches (400 x 200 mm) and nominal depths as indicated on drawings for specific locations.
   3. Non-Loadbearing Units: ASTM C129.
      a. Hollow block, as indicated.
      b. Lightweight.
   4. Pre-Faced Units: ASTM C90, hollow block, with smooth resinous facing complying with ASTM C744.

2.02 MORTAR AND GROUT MATERIALS

A. Mortar and Grout: As specified in Section 040511.

2.03 REINFORCEMENT AND ANCHORAGE

A. Reinforcing Steel: ASTM A615/A615M, Grade 40 (40,000 psi) (280 MPa) yield strength, deformed billet bars; galvanized.

B. Single Wythe Joint Reinforcement: ASTM A951/A951M.
   1. Type: Truss or ladder.
   2. Material: ASTM A1064/A1064M steel wire, mill galvanized to ASTM A641/A641M Class 3.
   3. Size: 0.1483 inch (3.8 mm) side rods with 0.1483 inch (3.8 mm) cross rods; width as required to provide not less than 5/8 inch (16 mm) of mortar coverage on each exposure.

PART 3 EXECUTION

3.01 COURSING

A. Establish lines, levels, and coursing indicated. Protect from displacement.

B. Maintain masonry courses to uniform dimension. Form vertical and horizontal joints of uniform thickness.

C. Concrete Masonry Units:
   1. Bond: Running.
   2. Coursing: One unit and one mortar joint to equal 8 inches (200 mm).
   3. Mortar Joints: Concave.

3.02 PLACING AND BONDING

A. Lay solid masonry units in full bed of mortar, with full head joints, uniformly jointed with other work.

B. Lay hollow masonry units with face shell bedding on head and bed joints.

C. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

3.03 REINFORCEMENT AND ANCHORAGE

A. Install horizontal joint reinforcement 16 inches (400 mm) on center.

B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches (400 mm) each side of opening.

C. Place continuous joint reinforcement in first and second joint below top of walls.

D. Lap joint reinforcement ends minimum 6 inches (150 mm).

3.04 LINTELS

A. Maintain minimum 8" bearing on each side of opening.

3.05 BUILT-IN WORK

A. As work progresses, install built-in metal door frames and other items to be built into the work and furnished under other sections.

B. Install built-in items plumb, level, and true to line.

C. Bed anchors of metal door and glazed frames in adjacent mortar joints. Fill frame voids solid with grout.

1. Fill adjacent masonry cores with grout minimum 12 inches (300 mm) from framed openings.

3.06 TOLERANCES

A. Install masonry within the site tolerances found in TMS 402/602.

B. Maximum Variation From Unit to Adjacent Unit: 1/16 inch (1.6 mm).

C. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft (6 mm/3 m) and 1/2 inch in 20 ft (13 mm/6 m) or more.

D. Maximum Variation from Plumb: 1/4 inch (6 mm) per story non-cumulative; 1/2 inch (13 mm) in two stories or more.

E. Maximum Variation from Level Coursing: 1/8 inch in 3 ft (3 mm/m) and 1/4 inch in 10 ft (6 mm/3 m); 1/2 inch in 30 ft (13 mm/9 m).

F. Maximum Variation of Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch (minus 6.4 mm, plus 9.5 mm).

G. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch (6 mm).

3.07 CUTTING AND FITTING

A. Cut and fit for access to new areas. Coordinate with other sections of work to provide correct size, shape, and location.

B. Obtain approval prior to cutting or fitting masonry work not indicated or where appearance or strength of masonry work may be impaired.

3.08 CLEANING

A. Remove excess mortar and mortar smears as work progresses.

B. Use non-metallic tools in cleaning operations.

3.09 PROTECTION

A. Without damaging completed work, provide protective boards at exposed external corners that are subject to damage by construction activities.

END OF SECTION

SECTION 054000
COLD-FORMED METAL FRAMING

PART 1 - GENERAL

1.1 **SUMMARY**

A. Section Includes:

1. Exterior non-load-bearing wall framing.
2. Interior non-load-bearing wall framing exceeding height limitations of standard, nonstructural metal framing.
3. Ceiling joist framing.

1.2 **PREINSTALLATION MEETINGS**

A. Preinstallation Conference: Conduct conference at Project site.

1.3 **ACTION SUBMITTALS**

A. Product Data: For each type of product.

B. Shop Drawings:

1. Include layout, spacings, sizes, thicknesses, and types of cold-formed steel framing; fabrication; and fastening and anchorage details, including mechanical fasteners.
2. Indicate reinforcing channels, opening framing, supplemental framing, strapping, bracing, bridging, splices, accessories, connection details, and attachment to adjoining work.

C. Delegated-Design Submittal: For cold-formed steel framing.

1.4 **INFORMATIONAL SUBMITTALS**

A. Qualification Data: For engineer and testing agency.

B. Welding certificates.

C. Product Certificates: For each type of code-compliance certification for studs and tracks.

D. Product Test Reports: For each listed product, for tests performed by manufacturer and witnessed by a qualified testing agency or by a qualified testing agency.

1. Steel sheet.
2. Expansion anchors.
3. Power-actuated anchors.
4. Mechanical fasteners.

5. Vertical deflection clips.
6. Horizontal drift deflection clips
7. Miscellaneous structural clips and accessories.

E. Evaluation Reports: For nonstandard cold-formed steel framing post-installed anchors and power-actuated fasteners, from ICC-ES or other qualified testing agency acceptable to Architect.

1.5 QUALITY ASSURANCE

A. Testing Agency Qualifications: Qualified according to ASTM E 329 for testing indicated.

B. Product Tests: Mill certificates or data from a qualified independent testing agency, or in-house testing with calibrated test equipment, indicating steel sheet complies with requirements, including base-metal thickness, yield strength, tensile strength, total elongation, chemical requirements, and metallic-coating thickness.

C. Code-Compliance Certification of Studs and Tracks: Provide documentation that framing members are certified according to the product-certification program of the Certified Steel Stud Association, the Steel Framing Industry Association or the Steel Stud Manufacturers Association.

D. Welding Qualifications: Qualify procedures and personnel according to the following:

1. AWS D1.1/D1.1M, "Structural Welding Code - Steel."
2. AWS D1.3/D1.3M, "Structural Welding Code - Sheet Steel."

PART 2 - PRODUCTS

2.1 MANUFACTURERS:

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering cold-formed metal framing that may be incorporated into the Work include, but are not limited to, the following:

1. Allied Studco.
2. AllSteel Products, Inc.
3. California Expanded Metal Products Company.
4. Clark Steel Framing.
5. Consolidated Fabricators Corp.; Building Products Division.
6. Craco Metals Manufacturing, LLC.
7. Custom Stud, Inc.
8. Dale/Incor.
9. Design Shapes in Steel.
10. Dietrich Metal Framing; a Worthington Industries Company.
11. Formetal Co. Inc. (The).
12. Innovative Steel Systems.
13. MarinoWare; a division of Ware Industries.
14. Quail Run Building Materials, Inc.
15. SCAFCO Corporation.
16. Southeastern Stud & Components, Inc.
17. Steel Construction Systems.

18. Steeler, Inc.
19. Super Stud Building Products, Inc.
20. United Metal Products, Inc.

2.2 PERFORMANCE REQUIREMENTS

A. Delegated Design: Engage a qualified professional engineer, as defined in Section 014000 "Quality Requirements," to design cold-formed steel framing.

B. Structural Performance: Provide cold-formed steel framing capable of withstanding design loads within limits and under conditions indicated.

1. Design Loads: As indicated on Drawings.
2. Deflection Limits: Design framing systems to withstand design loads without deflections greater than the following:
    a. Interior Load-Bearing Wall Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
    b. Exterior Non-Load-Bearing Framing: Horizontal deflection of 1/600 of the wall height.
    c. Interior Non-Load-Bearing Framing: Horizontal deflection of 1/360 of the wall height under a horizontal load of 5 lbf/sq. ft. (239 Pa).
    d. Ceiling Joist Framing: Vertical deflection of 1/360 of the span for live loads and 1/240 for total loads of the span.

3. Design framing systems to provide for movement of framing members located outside the insulated building envelope without damage or overstressing, sheathing failure, connection failure, undue strain on fasteners and anchors, or other detrimental effects when subject to a maximum ambient temperature change of 120 deg F (67 deg C).
4. Design framing system to maintain clearances at openings, to allow for construction tolerances, and to accommodate live load deflection of primary building structure as follows:

    a. Upward and downward movement of 3/4 inch (19 mm).

5. Design exterior non-load-bearing wall framing to accommodate horizontal deflection without regard for contribution of sheathing materials.

C. Cold-Formed Steel Framing Standards: Unless more stringent requirements are indicated, framing shall comply with AISI S100, AISI S200, and the following:

1. Floor and Roof Systems: AISI S210.
2. Wall Studs: AISI S211.
3. Headers: AISI S212.
4. Lateral Design: AISI S213.

D. Fire-Resistance Ratings: Comply with ASTM E 119; testing by a qualified testing agency. Identify products with appropriate markings of applicable testing agency.

1. Indicate design designations from UL's "Fire Resistance Directory" or from the listings of another qualified testing agency acceptable to authorities having jurisdiction.

2.3 COLD-FORMED STEEL FRAMING MATERIALS

A. Steel Sheet: ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated, of grade and coating designation as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180), A60 (ZF180), AZ50 (AZM150), or GF30 (ZGF90).

B. Steel Sheet for Clips: ASTM A 653/A 653M, structural steel, zinc coated, of grade and coating as follows:

1. Grade: As required by structural performance.
2. Coating: G60 (Z180).

2.4 INTERIOR NON-LOAD-BEARING WALL FRAMING

A. Steel Studs: Manufacturer's standard C-shaped steel studs, of web depths indicated, punched, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm).
3. Section Properties: as required by delegated design for loading(s) indicated.

B. Steel Track: Manufacturer's standard U-shaped steel track, of web depths indicated, unpunched, with unstiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: Matching steel studs.
2. Flange Width: 1-1/4 inches (32 mm).

C. Vertical Deflection Clips: Manufacturer's standard [bypass] [head] clips, capable of accommodating upward and downward vertical displacement of primary structure through positive mechanical attachment to stud web.

1. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

a. Dietrich Metal Framing; a Worthington Industries Company.
b. MarinoWare, a division of Ware Industries.
c. SCAFCO Corporation
d. The Steel Network, Inc.

D. Double Deflection Tracks: Manufacturer's double, deep-leg, U-shaped steel tracks, consisting of nested inner and outer tracks; unpunched, with unstiffened flanges.

1. Outer Track: Of web depth to allow free vertical movement of inner track, with flanges designed to support horizontal loads and transfer them to the primary structure, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
b. Flange Width: 2 ½ inches (76 mm).

2. Inner Track: Of web depth indicated, and as follows:

a. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
b. Flange Width: 1-1/4 inches (32 mm).

E. Drift Clips: Manufacturer's standard bypass or head clips, capable of isolating wall stud from upward and downward vertical displacement and lateral drift of primary structure through positive mechanical attachment to stud web and structure.

2.5 CEILING JOIST FRAMING

A. Steel Ceiling Joists: Manufacturer's standard C-shaped steel sections, of web depths indicated, punched with standard holes, with stiffened flanges, and as follows:

1. Minimum Base-Metal Thickness: 0.0428 inch (1.09 mm).
2. Flange Width: 1-5/8 inches (41 mm), minimum.
3. Section Properties: As required by delegated design for loading(s) and deflection requirements specified.

2.6 FRAMING ACCESSORIES

A. Fabricate steel-framing accessories from ASTM A 1003/A 1003M, Structural Grade, Type H, metallic coated steel sheet, of same grade and coating designation used for framing members.

B. Provide accessories of manufacturer's standard thickness and configuration, unless otherwise indicated, as follows:

1. Supplementary framing.
2. Bracing, bridging, and solid blocking.
3. Web stiffeners.
4. Anchor clips.
5. End clips.
6. Foundation clips.
7. Gusset plates.
8. Stud kickers and knee braces.
9. Joist hangers and end closures.
10. Hole-reinforcing plates.
11. Backer plates.

2.7 ANCHORS, CLIPS, AND FASTENERS

A. Steel Shapes and Clips: ASTM A 36/A 36M, zinc coated by hot-dip process according to ASTM A 123/A 123M.

B. Anchor Bolts: ASTM F 1554, Grade 36, threaded carbon-steel hex-headed bolts, carbon-steel nuts, and flat, hardened-steel washers; zinc coated by hot-dip process according to ASTM A 153/A 153M, Class C.

C. Post-Installed Anchors: Fastener systems with bolts of same basic metal as fastened metal, if visible, unless otherwise indicated; with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC01, ICC-ES AC193, ICC-ES AC58 or ICC-ES AC308 as appropriate for the substrate.

1. Uses: Securing cold-formed steel framing to structure.
2. TypeTorque-controlled adhesive anchor or adhesive anchor.
3. Material for Interior Locations: Carbon-steel components zinc plated to comply with ASTM B 633 or ASTM F 1941 (ASTM F 1941M), Class Fe/Zn 5, unless otherwise indicated.

D. Power-Actuated Anchors: Fastener systems with working capacity greater than or equal to the design load, according to an evaluation report acceptable to authorities having jurisdiction, based on ICC-ES AC70.

E. Mechanical Fasteners: ASTM C 1513, corrosion-resistant-coated, self-drilling, self-tapping, steel drill screws.

1. Head Type: Low-profile head beneath sheathing; manufacturer's standard elsewhere.

F. Welding Electrodes: Comply with AWS standards.

G.

2.8 MISCELLANEOUS MATERIALS

A. Galvanizing Repair Paint: ASTM A 780/A 780M.

B. Cement Grout: Portland cement, ASTM C 150/C 150M, Type I; and clean, natural sand, ASTM C 404. Mix at ratio of 1 part cement to 2-1/2 parts sand, by volume, with minimum water required for placement and hydration.

C. Nonmetallic, Nonshrink Grout: Factory-packaged, nonmetallic, noncorrosive, nonstaining grout, complying with ASTM C 1107/C 1107M, and with a fluid consistency and 30-minute working time.

D. Shims: Load-bearing, high-density, multimonomer, nonleaching plastic; or cold-formed steel of same grade and metallic coating as framing members supported by shims.

E. Sealer Gaskets: Closed-cell neoprene foam, 1/4 inch (6 mm) thick, selected from manufacturer's standard widths to match width of bottom track or rim track members as required.

2.9 FABRICATION

A. Fabricate cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened, according to referenced AISI's specifications and standards, manufacturer's written instructions, and requirements in this Section.

1. Fabricate framing assemblies using jigs or templates.
2. Cut framing members by sawing or shearing; do not torch cut.
3. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, pneumatic pin fastening, or riveting as standard with fabricator. Wire tying of framing members is not permitted.

   a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
   b. Locate mechanical fasteners and install according to Shop Drawings, with screws penetrating joined members by no fewer than three exposed screw threads.

4. Fasten other materials to cold-formed steel framing by welding, bolting, pneumatic pin

fastening, or screw fastening, according to Shop Drawings.

B. Reinforce, stiffen, and brace framing assemblies to withstand handling, delivery, and erection stresses. Lift fabricated assemblies by means that prevent damage or permanent distortion.

C. Tolerances: Fabricate assemblies level, plumb, and true to line to a maximum allowable variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Spacing: Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.
2. Squareness: Fabricate each cold-formed steel framing assembly to a maximum out-of-square tolerance of 1/8 inch (3 mm).

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, conditions, and abutting structural framing for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Install load-bearing shims or grout between the underside of load-bearing wall bottom track and the top of foundation wall or slab at locations with a gap larger than 1/4 inch (6 mm) to ensure a uniform bearing surface on supporting concrete or masonry construction.

B. Install sealer gaskets at the underside of wall bottom track or rim track and at the top of foundation wall or slab at stud or joist locations.

3.3 INSTALLATION, GENERAL

A. Cold-formed steel framing may be shop or field fabricated for installation, or it may be field assembled.

B. Install cold-formed steel framing according to AISI S200, AISI S202, and manufacturer's written instructions unless more stringent requirements are indicated.

C. Install shop- or field-fabricated, cold-formed framing and securely anchor to supporting structure.

1. Screw, bolt, or weld wall panels at horizontal and vertical junctures to produce flush, even, true-to-line joints with maximum variation in plane and true position between fabricated panels not exceeding 1/16 inch (1.6 mm).

D. Install cold-formed steel framing and accessories plumb, square, and true to line, and with connections securely fastened.

1. Cut framing members by sawing or shearing; do not torch cut.

2. Fasten cold-formed steel framing members by welding, screw fastening, clinch fastening, or riveting. Wire tying of framing members is not permitted.

    a. Comply with AWS D1.3/D1.3M requirements and procedures for welding, appearance and quality of welds, and methods used in correcting welding work.
    b. Locate mechanical fasteners, install according to Shop Drawings, and comply with requirements for spacing, edge distances, and screw penetration.

E. Install framing members in one-piece lengths unless splice connections are indicated for track or tension members.

F. Install temporary bracing and supports to secure framing and support loads equal to those for which structure was designed. Maintain braces and supports in place, undisturbed, until entire integrated supporting structure has been completed and permanent connections to framing are secured.

G. Do not bridge building expansion joints with cold-formed steel framing. Independently frame both sides of joints.

H. Install insulation, specified in "Thermal Insulation" specification, in framing-assembly members, such as headers, sills, boxed joists, and multiple studs at openings, that are inaccessible on completion of framing work.

I. Fasten hole-reinforcing plate over web penetrations that exceed size of manufacturer's approved or standard punched openings.

3.4 JOIST INSTALLATION

A. Install perimeter joist track sized to match joists. Align and securely anchor or fasten track to supporting structure at corners, ends, and spacings indicated on Shop Drawings.

B. Install joists bearing on supporting frame, level, straight, and plumb; adjust to final position, brace, and reinforce. Fasten joists to both flanges of joist track.

1. Install joists over supporting frame with a minimum end bearing of 1-1/2 inches (38 mm).
2. Reinforce ends and bearing points of joists with web stiffeners, end clips, joist hangers, steel clip angles, or steel-stud sections.

C. Space joists not more than 2 inches (51 mm) from abutting walls, and as follows:

1. Joist Spacing: 16 inches (406 mm).

D. Frame openings with built-up joist headers, consisting of joist and joist track or another combination of connected joists if indicated.

E. Install joist reinforcement at interior supports with single, short length of joist section located directly over interior support, with lapped joists of equal length to joist reinforcement.

1. Install web stiffeners to transfer axial loads of walls above.

F. Install bridging at intervals indicated on Shop Drawings. Fasten bridging at each joist intersection

as follows:

1. Joist-Track Solid Bridging: Joist-track solid blocking of width and thickness indicated, secured to joist webs.
2. Combination Bridging: Combination of flat, taut, steel sheet straps of width and thickness indicated and joist-track solid blocking of width and thickness indicated. Fasten flat straps to bottom flange of joists and secure solid blocking to joist webs.

G. Secure joists to load-bearing interior walls to prevent lateral movement of bottom flange.

H. Install miscellaneous joist framing and connections, including web stiffeners, closure pieces, clip angles, continuous angles, hold-down angles, anchors, and fasteners, to provide a complete and stable joist-framing assembly.

3.5 ERECTION TOLERANCES

A. Install cold-formed steel framing level, plumb, and true to line to a maximum allowable tolerance variation of 1/8 inch in 10 feet (1:960) and as follows:

1. Space individual framing members no more than plus or minus 1/8 inch (3 mm) from plan location. Cumulative error shall not exceed minimum fastening requirements of sheathing or other finishing materials.

3.6 FIELD QUALITY CONTROL

A. Testing: Owner will engage a qualified independent testing and inspecting agency to perform field tests and inspections and prepare test reports.

B. Field and shop welds will be subject to testing and inspecting.

C. Testing agency will report test results promptly and in writing to Contractor and Architect.

D. Cold-formed steel framing will be considered defective if it does not pass tests and inspections.

E. Additional testing and inspecting, at Contractor's expense, will be performed to determine compliance of replaced or additional work with specified requirements.

3.7 REPAIRS AND PROTECTION

A. Galvanizing Repairs: Prepare and repair damaged galvanized coatings on fabricated and installed cold-formed steel framing with galvanized repair paint according to ASTM A 780/A 780M and manufacturer's written instructions.

B. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure that cold-formed steel framing is without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 061000
ROUGH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Preservative treated wood materials.

B. Fire retardant treated wood materials.

C. Communications and electrical room mounting boards.

D. Concealed wood blocking, nailers, and supports.

1.02 REFERENCE STANDARDS

A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2024.

C. PS 1 - Structural Plywood; 2023.

D. PS 20 - American Softwood Lumber Standard; 2025.

E. SPIB (GR) - Standard Grading Rules; 2021.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide technical data on insulated sheathing, wood preservative materials, and application instructions.

1.04 DELIVERY, STORAGE, AND HANDLING

A. General: Cover wood products to protect against moisture. Support stacked products to prevent deformation and to allow air circulation.

B. Fire Retardant Treated Wood: Prevent exposure to precipitation during shipping, storage, and installation.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
   1. If no species is specified, provide species graded by the agency specified; if no grading agency is specified, provide lumber graded by grading agency meeting the specified requirements.
   2. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee at www.alsc.org, and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

2.02 DIMENSION LUMBER FOR CONCEALED APPLICATIONS

A. Sizes: Nominal sizes as indicated on drawings, S4S.

B. Moisture Content: S-dry or MC19.

C. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
   1. Lumber: S4S, No. 2 or Standard Grade.
   2. Boards: Standard or No. 3.

2.03 CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: PS 1 A-D plywood, or medium density fiberboard; 3/4 inch (19 mm) thick; flame spread index of 25 or less, smoke developed index of 450 or less, when tested in accordance with ASTM E84.

2.04 FACTORY WOOD TREATMENT

A. Treated Lumber and Plywood: Comply with requirements of AWPA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
   1. Fire-Retardant Treated Wood: Mark each piece of wood with producer's stamp indicating compliance with specified requirements.
   2. Preservative-Treated Wood: Provide lumber and plywood marked or stamped by an ALSC-accredited testing agency, certifying level and type of treatment in accordance with AWPA standards.

B. Fire Retardant Treatment:
   1. Interior Type A: AWPA U1, Use Category UCFA, Commodity Specification H, low temperature (low hygroscopic) type, chemically treated and pressure impregnated; capable of providing a maximum flame spread index of 25 when tested in accordance with ASTM E84, with no evidence of significant combustion when test is extended for an additional 20 minutes.
      a. Kiln dry wood after treatment to a maximum moisture content of 19 percent for lumber and 15 percent for plywood.
      b. Treat rough carpentry items as indicated .
      c. Do not use treated wood in applications exposed to weather or where the wood may become wet.

C. Preservative Treatment:
   1. Preservative Pressure Treatment of Lumber Above Grade: AWPA U1, Use Category UC3B, Commodity Specification A using waterborne preservative.
      a. Kiln dry lumber after treatment to maximum moisture content of 19 percent.
      b. Treat lumber in contact with masonry or concrete.

PART 3 EXECUTION

3.01 INSTALLATION - GENERAL

A. Select material sizes to minimize waste.

B. Reuse scrap to the greatest extent possible; clearly separate scrap for use on site as accessory components, including: shims, bracing, and blocking.

C. Where treated wood is used on interior, provide temporary ventilation during and immediately after installation sufficient to remove indoor air contaminants.

3.02 BLOCKING, NAILERS, AND SUPPORTS

A. Provide framing and blocking members as indicated or as required to support finishes, fixtures, specialty items, and trim.

B. In framed assemblies that have concealed spaces, provide solid wood fireblocking as required by applicable local code, to close concealed draft openings between floors and between top story and roof/attic space; other material acceptable to authorities having jurisdiction may be used in lieu of solid wood blocking.

C. In metal stud walls, provide continuous blocking around door and window openings for anchorage of frames, securely attached to stud framing.

D. In walls, provide blocking attached to studs as backing and support for wall-mounted items, unless item can be securely fastened to two or more studs or other method of support is explicitly indicated.

E. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.

3.03 INSTALLATION OF CONSTRUCTION PANELS

A. Communications and Electrical Room Mounting Boards: Secure with screws to studs with edges over firm bearing; space fasteners at maximum 24 inches (610 mm) on center on all edges and into studs in field of board.
   1. At fire-rated walls, install board over wall board indicated as part of the fire-rated assembly.
   2. Where boards are indicated as full floor-to-ceiling height, install with long edge of board parallel to studs.
   3. Install adjacent boards without gaps.

END OF SECTION

SECTION 062000
FINISH CARPENTRY

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Finish carpentry items.

B. Wood door frames, glazed frames.

C. Wood casings and moldings.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 064100 - Architectural Wood Casework: Shop fabricated custom cabinet work.

D. Section 064200 - Wood Paneling: Shop fabricated custom paneling.

E. Section 099300 - Staining and Transparent Finishing: Staining and transparent finishing of finish carpentry items.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI A135.4 - Basic Hardboard; 2012 (Reaffirmed 2020).

C. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2023.

D. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2023d.

E. AWI (QCP) - Quality Certification Program; Current Edition.

F. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

G. AWMAC (GIS) - Guarantee and Inspection Services Program; Current Edition.

H. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

I. BHMA A156.9 - Cabinet Hardware; 2020.

J. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.

K. PS 1 - Structural Plywood; 2023.

L. PS 20 - American Softwood Lumber Standard; 2025.

M. WI (CCP) - Certified Compliance Program (CCP); Current Edition.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data:
   1. Provide manufacturer's product data, storage and handling instructions for factory-fabricated units.
   2. Provide data on fire retardant treatment materials and application instructions.
   3. Provide instructions for attachment hardware, finish hardware, and _____.

C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.

1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
3. Include certification program label.

D. Samples: Submit two samples of wood trim 6" long.

E. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

F. Manufacturer's Instructions: Provide manufacturer's installation instructions for factory-fabricated units.

1.06 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
1. Company with at least one project within the past 5 years with value of woodwork within 20 percent of cost of woodwork for this project.
2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:
1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
a. This AWI (QCP) project is registered as project number _____.
2. Comply with AWMAC (GIS) woodwork association quality certification service/program in accordance with requirements for work specified in this section.
3. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section www.woodworkinstitute.com/#sle.
4. Provide labels or certificates indicating that work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
5. Provide designated labels on shop drawings as required by certification program.
6. Provide designated labels on installed products as required by certification program.
7. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

1.07 MOCK-UPS

A. See Section 014000 - Quality Requirements for additional requirements.

B. Mock-up may remain as part of the work.

1.08 DELIVERY, STORAGE, AND HANDLING

A. Deliver factory-fabricated units to project site in original packages, containers or bundles bearing brand name and identification.

B. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.

C. Protect from moisture damage.

D. Handle materials and products to prevent damage to edges, ends, or surfaces.

PART 2 PRODUCTS

2.01 FINISH CARPENTRY ITEMS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

B. Surface Burning Characteristics: Provide materials having fire and smoke properties as required by applicable code.

C. Interior Woodwork Items:
   1. Moldings, Bases, Casings, and Miscellaneous Trim: Clear white pine; prepare for paint finish.
   2. All new work to match existing wood species and stain.

2.02 SHEET MATERIALS

A. Softwood Plywood, Not Exposed to View: Any face species, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.

2.03 PLASTIC LAMINATE MATERIALS

A. Plastic Laminate: Basis of design or preapproved equal: Wilsonart - steel mesh 4879-38, velvet finish.
   1. Products:
      a. Substitutions: See Section 016000 - Product Requirements.
   2. Manufacturers:
      a. Wilsonart
      b. Nevamar
      c. Formica

B. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

2.04 FASTENINGS

A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.

2.05 WOOD TREATMENT

A. Factory-Treated Lumber: Comply with requirements of AWPA U1 - Use Category System for pressure impregnated wood treatments determined by use categories, expected service conditions, and specific applications.

B. Redry wood after pressure treatment to maximum 19 percent moisture content.

2.06 FABRICATION

A. Shop assemble work for delivery to site, permitting passage through building openings.

B. Cap exposed plastic laminate finish edges with material of same finish and pattern.

C. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.

D. Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)

2.07 SHOP FINISHING

A. Sand work smooth and set exposed nails and screws.

B. Apply wood filler in exposed nail and screw indentations.

C. On items to receive transparent finishes, use wood filler that matches surrounding surfaces and is of type recommended for the applicable finish.

D. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows: **Spec to be completed with Finsishes**

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

B. Verify mechanical, electrical, and building items affecting work of this section are placed and ready to receive this work.

3.02 INSTALLATION

A. Install custom fabrications in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade indicated.

B. Set and secure materials and components in place, plumb and level.

C. Carefully scribe work abutting other components, with maximum gaps of 1/32 inch (0.79 mm). Do not use additional overlay trim to conceal larger gaps.

3.03 TOLERANCES

A. Maximum Variation from True Position: 1/16 inch (1.6 mm).

B. Maximum Offset from True Alignment with Abutting Materials: 1/32 inch (0.79 mm).

END OF SECTION

SECTION 064100
ARCHITECTURAL WOOD CASEWORK

PART 1 GENERAL

1.01 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

B. Section 061000 - Rough Carpentry: Support framing, grounds, and concealed blocking.

C. Section 099300 - Staining and Transparent Finishing: Field finishing of cabinet exterior.

D. Section 123600 - Countertops.

1.02 REFERENCE STANDARDS

A. AWI (QCP) - Quality Certification Program; Current Edition.

B. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards, 2nd Edition; 2014, with Errata (2016).

C. AWMAC (GIS) - Guarantee and Inspection Services Program; Current Edition.

D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards; 2021, with Errata.

E. BHMA A156.9 - Cabinet Hardware; 2020.

F. WI (CCP) - Certified Compliance Program (CCP); Current Edition.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Preinstallation Meeting: Convene a preinstallation meeting not less than one week before starting work of this section; require attendance by all affected installers.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
   1. Scale of Drawings: 1-1/2 inch to 1 foot (125 mm to 1 m), minimum.
   2. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
   3. Include certification program label.

C. Product Data: Provide data for hardware accessories.

D. Samples: Submit actual samples of architectural cabinet construction, minimum 12 inches (300 mm) square, illustrating proposed cabinet, countertop, and shelf unit substrate and finish.

E. Samples: Submit actual sample items of proposed pulls, hinges, shelf standards, and locksets, demonstrating hardware design, quality, and finish.

F. Certificate: Submit labels and certificates required by quality assurance and quality control programs.

1.05 QUALITY ASSURANCE

A. Fabricator Qualifications: Company specializing in fabricating the products specified in this section with minimum five years of documented experience.
   1. Company with at least one project in the past 5 years with value of woodwork within 20 percent of cost of woodwork for this Project.
   2. Accredited participant in the specified certification program prior to the commencement of fabrication and throughout the duration of the project.
   3. Single Source Responsibility: Provide and install this work from single fabricator.

B. Quality Certification:
   1. Comply with AWI (QCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awiqcp.org/#sle.
      a. This AWI (QCP) project is registered as project number _____.

2. Comply with AWMAC (GIS) woodwork association quality certification service/program in accordance with requirements for work specified in this section: www.awmac.com/#sle.
3. Comply with WI (CCP) woodwork association quality certification service/program in accordance with requirements for work specified in this section: https://woodworkinstitute.com/#sle.
4. Provide labels or certificates indicating that the installed work complies with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
5. Provide designated labels on shop drawings as required by certification program.
6. Provide designated labels on installed products as required by certification program.
7. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.
8. Replace, repair, or rework all work for which certification is refused.

1.06 MOCK-UPS

A. Provide mock-up of typical base cabinet, wall cabinet, and countertop, including hardware, finishes, and plumbing accessories.

B. See Section 014000 - Quality Requirements for additional requirements.

C. Locate where directed.

D. Mock-up may remain as part of the work.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Protect units from moisture damage.

1.08 FIELD CONDITIONS

A. During and after installation of custom cabinets, maintain temperature and humidity conditions in building spaces at same levels planned for occupancy.

PART 2 PRODUCTS

2.01 CABINETS

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless noted otherwise.

2.02 WOOD-BASED COMPONENTS

A. Wood fabricated from old growth timber is not permitted.

2.03 COUNTERTOPS

A. Countertops: See Section 123600.

2.04 ACCESSORIES

A. Adhesive: Type recommended by fabricator to suit application.
   1. Manufacturers:
      a. Franklin International, Inc; Titebond Original Wood Glue: www.titebond.com/#sle.
      b. Substitutions: See Section 016000 - Product Requirements.

2.05 HARDWARE

A. Cabinet Hardware: Comply with BHMA A156.9 for hardware types and grades indicated below:
   1. Hardware Types: As indicated on drawings.
   2. Product Grade: Grade 2.

2.06 FABRICATION

A. Assembly: Shop assemble cabinets for delivery to site in units easily handled and to permit passage through building openings.

B. Edging: Fit shelves, doors, and exposed edges with specified edging. Do not use more than one piece for any single length.

C. Fitting: When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide matching trim for scribing and site cutting.

D. Plastic Laminate: Apply plastic laminate finish in full uninterrupted sheets consistent with manufactured sizes. Fit corners and joints hairline; secure with concealed fasteners. Slightly bevel arises. Locate counter butt joints minimum 2 feet from sink cut-outs. (Locate counter butt joints minimum 600 mm from sink cut-outs.)
   1. Apply laminate backing sheet to reverse side of plastic laminate finished surfaces.
   2. Cap exposed plastic laminate finish edges with material of same finish and pattern.

E. Matching Wood Grain: Comply with requirements of quality standard for specified Grade and as follows:

2.07 SHOP FINISHING

A. For opaque finishes, apply wood filler in exposed nail and screw indentations and sand smooth.

B. On items to receive transparent finishes, use wood filler matching or blending with surrounding surfaces and of types recommended for applied finishes.

C. Finish work in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), Section 5 - Finishing for grade specified and as follows:

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify adequacy of backing and support framing.

3.02 INSTALLATION

A. Set and secure custom cabinets in place, assuring that they are rigid, plumb, and level.

3.03 ADJUSTING

A. Adjust installed work.

B. Adjust moving or operating parts to function smoothly and correctly.

3.04 CLEANING

A. Clean casework, counters, shelves, hardware, fittings, and fixtures.

END OF SECTION

SECTION 064200
WOOD PANELING

PART 2 PRODUCTS

1.01 PANELING

A. Quality Standard: Custom Grade, in accordance with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS), unless otherwise indicated.

1.02 WOOD-BASED MATERIALS - GENERAL

1.03 FABRICATION

A. Prepare panels for delivery to site, permitting passage through building openings.

B. Finish exposed edges of panels as specified by grade requirements.

END OF SECTION

SECTION 079200
JOINT SEALANTS - DOW SILICONES CORPORATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Nonsag gunnable joint sealants.

B. Joint backings and accessories.

1.02 RELATED REQUIREMENTS

A. Section 016116 - Volatile Organic Compound (VOC) Content Restrictions.

1.03 REFERENCE STANDARDS

A. ASTM C794 - Standard Test Method for Adhesion-in-Peel of Elastomeric Joint Sealants; 2018 (Reapproved 2022).

B. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2022.

C. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2023.

D. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

E. SWRI (VAL) - SWR Institute Validated Products Directory; Current Edition.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data for Joint Sealants: Submit manufacturer's technical datasheets for each product to be used, and include the following:
   1. Physical characteristics, including movement capability, VOC content, hardness, cure time, and color availability.
   2. List of backing materials approved for use with the specific product.
   3. Substrates that product is known to satisfactorily adhere to and with which it is compatible.
   4. Substrates that product is not compatible with.
   5. Substrates that primer is required.
   6. Substrates that laboratory adhesion and/or compatibility testing is required.
   7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
   8. Specimen warranty.
   9. Certification by manufacturer indicating that product complies with specification requirements.
   10. SWRI Validation: Provide currently available sealant product validations as listed by SWRI (VAL) for specified sealants.

C. Product Data for Accessories: Submit manufacturer's technical data sheet for each accessory product to be used, including physical characteristics, installation instructions, and recommended tools.

D. Color Cards for Selection: Where sealant color is not specified, submit manufacturer's color cards showing standard colors available for selection.

E. Samples for Verification: Where custom sealant color is specified, obtain directions from Architect and submit at least two physical samples for verification of color of each required sealant.

F. Sustainable Design Documentation: For sealants and primers, submit VOC content and emissions documentation; see Section 016116.

G. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.

H. Executed warranty.

1.05 QUALITY ASSURANCE

A. Maintain one copy of each referenced document covering installation requirements on site.

B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

C. Installer Qualifications: Company specializing in performing the work of this section and with at least three years of documented experience.

D. Preconstruction Laboratory Testing: Arrange for sealant manufacturer(s) to test each combination of sealant, substrate, backing, and accessories.
   1. Adhesion Testing: In accordance with ASTM C794.
   2. Compatibility Testing: In accordance with ASTM C1087.
   3. Allow sufficient time for testing to avoid delaying the work.
   4. Deliver sufficient samples to manufacturer for testing.
   5. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.

1.06 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide 2-year manufacturer warranty for installed sealants and accessories that fail to achieve a watertight seal, exhibit loss of adhesion or cohesion, or do not cure. Complete forms in Owner's name and register with manufacturer.

C. Extended Correction Period: Correct defective work within 2-year period commencing on Date of Substantial Completion.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Joint Sealants:
   1. Dow Silicones Corporation: www.dow.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 JOINT SEALANT APPLICATIONS

A. Scope:
   1. Interior Joints: Do not seal interior joints unless specifically indicated to be sealed. Interior joints to be sealed include, but are not limited to, the following items:
      a. Joints between door, window, and other frames and adjacent construction.
      b. In sound-rated wall and ceiling assemblies, gaps at electrical outlets, wiring devices, piping, and other openings; between wall/ceiling and other construction; and other flanking sound paths.
         1) Exception: Such gaps and openings in gypsum board and plaster finished stud walls and suspended ceilings.
         2) Exception: Through-penetrations in sound-rated assemblies that are also fire-rated.
      c. Other joints are indicated below.
   2. Do not seal the following types of joints:
      a. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
      b. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
      c. Joints where installation of sealant is specified in another section.
      d. Joints between suspended panel ceilings/grid and walls.

B. Type ___ - Interior Joints: Use nonsag silicone sealant, unless otherwise indicated.
   1. Type ___ - In Sound-Rated Assemblies: Silicone sealant.

C. Sound-Rated Assemblies: Walls and ceilings identified as STC-rated, sound-rated, or acoustical.

2.03 JOINT SEALANTS - GENERAL

2.04 NONSAG JOINT SEALANTS

2.05 ACCESSORIES

A. Backer Rod: Cylindrical cellular foam rod with surface that sealant will not adhere to, compatible with specific sealant used, and recommended by backing and sealant manufacturers for specific application.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that joints are ready to receive work.

B. Verify that backing materials are compatible with sealants.

C. Verify that backer rods are of the correct size.

3.02 PREPARATION

A. Remove loose materials and foreign matter that could impair adhesion of sealant.

B. Clean joints and prime as necessary, in accordance with manufacturer's instructions.

C. Perform preparation in accordance with manufacturer's instructions and ASTM C1193.

D. Mask elements and surfaces adjacent to joints from damage and disfigurement due to sealant work; be aware that sealant drips and smears may not be completely removable.

3.03 INSTALLATION

A. Install this work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.

B. Provide joint sealant installations complying with ASTM C1193.

C. Install acoustical sealant application work in accordance with ASTM C919.

D. Install bond breaker backing tape where backer rod cannot be used.

E. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.

F. Do not install sealant when ambient temperature is outside manufacturer's recommended temperature range, or will be outside that range during the entire curing period, unless manufacturer's approval is obtained and instructions are followed.

G. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

3.04 FIELD QUALITY CONTROL

A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.

B. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

END OF SECTION

SECTION 081113 - HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.2 SUMMARY

A. Section Includes:

1. Standard and custom hollow metal doors and frames.
2. Steel sidelight, borrowed lite and transom frames.
3. Louvers installed in hollow metal doors.
4. Light frames and glazing installed in hollow metal doors.

B. Related Sections:

1. Division 01 Section "General Conditions".
2. Division 04 Section "Unit Masonry" for embedding anchors for hollow metal work into masonry construction.
3. Division 08 Section “Flush Wood Doors”.
4. Division 08 Section "Glazing" for glass view panels in hollow metal doors.
5. Division 08 Section "Door Hardware".
6. Division 08 Section "Access Control Hardware".
7. Division 09 Sections "Exterior Painting" and "Interior Painting" for field painting hollow metal doors and frames.

C. Codes and References: Comply with the version year adopted by the Authority Having Jurisdiction.

1. ANSI/SDI A250.8 - Recommended Specifications for Standard Steel Doors and Frames.
2. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames, Frames Anchors and Hardware Reinforcing.
3. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames.
4. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames.
5. ANSI/SDI A250.11 - Recommended Erection Instructions for Steel Frames.
6. ASTM A1008 - Standard Specification for Steel Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy and High-Strength Low-Alloy with Improved Formability.
7. ASTM A653 - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process.

8. ASTM A924 - Standard Specification for General Requirements for Steel Sheet, Metallic-Coated by the Hot-Dip Process.
9. ASTM C 1363 - Standard Test Method for Thermal Performance of Building Assemblies by Means of a Hot Box Apparatus.
10. ANSI/BHMA A156.115 - Hardware Preparation in Steel Doors and Frames.
11. ANSI/SDI 122 - Installation and Troubleshooting Guide for Standard Steel Doors and Frames.
12. ANSI/NFPA 80 - Standard for Fire Doors and Fire Windows; National Fire Protection Association.
13. ANSI/NFPA 105: Standard for the Installation of Smoke Door Assemblies.
14. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; National Fire Protection Association.
15. UL 10C - Positive Pressure Fire Tests of Door Assemblies.
16. UL 1784 - Standard for Air Leakage Tests of Door Assemblies.

1.3 SUBMITTALS

A. Product Data: For each type of product indicated. Include construction details, material descriptions, core descriptions, hardware reinforcements, profiles, anchors, fire-resistance rating, and finishes.

B. Door hardware supplier is to furnish templates, template reference number and/or physical hardware to the steel door and frame supplier in order to prepare the doors and frames to receive the finish hardware items.

C. Shop Drawings: Include the following:

1. Elevations of each door design.
2. Details of doors, including vertical and horizontal edge details and metal thicknesses.
3. Frame details for each frame type, including dimensioned profiles and metal thicknesses.
4. Locations of reinforcement and preparations for hardware.
5. Details of anchorages, joints, field splices, and connections.
6. Details of accessories.
7. Details of moldings, removable stops, and glazing.
8. Details of conduit and preparations for power, signal, and control systems.

D. Samples for Verification:

1. Samples are only required by request of the architect and for manufacturers that are not current members of the Steel Door Institute.

1.4 QUALITY ASSURANCE

A. Source Limitations: Obtain hollow metal doors and frames through one source from a single manufacturer wherever possible.

B. Quality Standard: In addition to requirements specified, furnish SDI-Certified manufacturer products that comply with ANSI/SDI A250.8, latest edition, "Recommended Specifications for Standard Steel Doors and Frames".

C. Fire-Rated Door Assemblies: Assemblies complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to UL10C (neutral pressure at 40” above sill) or UL 10C.

1. Oversize Fire-Rated Door Assemblies Construction: For units exceeding sizes of tested assemblies, attach construction label certifying doors are built to standard construction requirements for tested and labeled fire rated door assemblies except for size.
2. Temperature-Rise Limit: Where indicated and at vertical exit enclosures (stairwell openings) and exit passageways, provide doors that have a maximum transmitted temperature end point of not more than 450 deg F (250 deg C) above ambient after 30 minutes of standard fire-test exposure.
3. Smoke Control Door Assemblies: Comply with NFPA 105.

    a. Smoke "S" Label: Doors to bear “S” label, and include smoke and draft control gasketing applied to frame and on meeting stiles of pair doors.

D. Fire-Rated, Borrowed-Light Frame Assemblies: Assemblies complying with NFPA 80 that are listed and labeled, by a testing and inspecting agency acceptable to authorities having jurisdiction, for fire-protection ratings indicated, based on testing according to NFPA 257. Provide labeled glazing material.

E. Pre-Submittal Conference: Conduct conference in compliance with requirements in Division 01 Section "Project Meetings" with attendance by representatives of Supplier, Installer, and Contractor to review proper methods and procedures for installing hollow metal doors and frames and to verify installation of electrical knockout boxes and conduit at frames with electrified or access control hardware.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver hollow metal work palletized, wrapped, or crated to provide protection during transit and Project site storage. Do not use non-vented plastic.

B. Deliver welded frames with two removable spreader bars across bottom of frames, tack welded to jambs and mullions.

C. Store hollow metal work under cover at Project site. Place in stacks of five units maximum in a vertical position with heads up, spaced by blocking, on minimum 4-inch high wood blocking. Do not store in a manner that traps excess humidity.

1. Provide minimum 1/4-inch space between each stacked door to permit air circulation. Door and frames to be stacked in a vertical upright position.

1.6 PROJECT CONDITIONS

A. Field Measurements: Verify actual dimensions of openings by field measurements before fabrication.

1.7 COORDINATION

A. Coordinate installation of anchorages for hollow metal frames. Furnish setting drawings, templates, and directions for installing anchorages, including sleeves, concrete inserts, anchor bolts, and items with integral anchors. Deliver such items to Project site in time for installation.

B. Building Information Modeling (BIM) Support: Utilize designated BIM software tools and obtain training needed to successfully participate in the Project BIM processes. All technical disciplines are responsible for the product data integration and data reliability of their Work into the coordinated BIM applications.

1.8 WARRANTY

A. Special Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace doors that fail in materials or workmanship within specified warranty period.

B. Warranty includes installation and finishing that may be required due to repair or replacement of defective doors.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Manufacturers: Subject to compliance with requirements, provide steel doors and frames from a SDI Certified manufacturer:

1. CECO Door Products (C).
2. Curries Company (CU).
3. Steelcraft (S).

2.2 MATERIALS

A. Cold-Rolled Steel Sheet: ASTM A 1008/A 1008M, Commercial Steel (CS), Type B; suitable for exposed applications.

B. Metallic-Coated Steel Sheet: ASTM A 653/A 653M, Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

C. Frame Anchors: ASTM A 653/A 653M, Commercial Steel (CS), Commercial Steel (CS), Type B; with minimum G60 (Z180) or A60 (ZF180) metallic coating.

2.3 HOLLOW METAL DOORS

A. General: Provide 1-3/4 inch doors of design indicated, not less than thickness indicated; fabricated with smooth surfaces, without visible joints or seams on exposed faces unless otherwise indicated. Comply with ANSI/SDI A250.8 and ANSI/NAAMM HMMA 867.

B. Exterior Doors (Energy Efficient): Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A924 A60. Provide doors complying with requirements

indicated below by referencing ANSI/SDI A250.8 for level and model, ANSI/SDI A250.4 for physical performance level, and HMMA 867 for door construction.

1. Design: Flush panel.
2. Core Construction: Foamed in place polyurethane.
3. Level/Model: Level 2 and Physical Performance Level A (Extra Heavy Duty), Minimum 18 gauge (0.053 inch - 1.3-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

C. Exterior Doors: Face sheets fabricated of commercial quality hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Level/Model: Level 2 and Physical Performance Level A (Extra Heavy Duty), Minimum 18 gauge (0.053-inch - 1.3-mm) thick steel, Model 2.
3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.
4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

D. Interior Doors (Energy Efficient): Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A366 or 620. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.
2. Core Construction: Polystyrene.
3. Level/Model: Level 2 and Physical Performance Level A (Heavy Duty), Minimum 18 gauge (0.042 inch - 1.1-mm) thick steel, Model 2.
4. Vertical Edges: Vertical edges–to be mechanically interlocked with hairline seam. Beveled Lock Edge, 1/8 inch in 2 inches (3 mm in 50 mm).
5. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet. Doors with an inverted top channel to include a steel closure channel, screw

attached, with the web of the channel flush with the face sheets of the door. Plastic or composite channel fillers are not acceptable.

6. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9".
7. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

E. Interior Doors: Face sheets fabricated of commercial quality cold rolled steel that complies with ASTM A 1008/A 1008M. Provide doors complying with requirements indicated below by referencing ANSI/SDI A250.8 for level and model and ANSI/SDI A250.4 for physical performance level:

1. Design: Flush panel.

    a. Fire Door Core: As required to provide fire-protection and temperature-rise ratings indicated.

2. Level/Model: Level 2 and Physical Performance Level B (Heavy Duty), Minimum 18 gauge (0.042-inch - 1.0-mm) thick steel, Model 2.
3. Top and Bottom Edges: Reinforce tops and bottoms of doors with a continuous steel channel not less than 16 gauge, extending the full width of the door and welded to the face sheet.
4. Hinge Reinforcement: Minimum 7 gauge (3/16") plate 1-1/4" x 9" or minimum 14 gauge continuous channel with pierced holes, drilled and tapped.
5. Hardware Reinforcements: Fabricate according to ANSI/SDI A250.6 with reinforcing plates from same material as door face sheets.

F. Manufacturers Basis of Design:

1. Ceco - Polystyrene Core - LP Series.

2.4 HOLLOW METAL FRAMES

A. General: Comply with ANSI/SDI A250.8 and with details indicated for type and profile.

B. Thermal Break Frames: Subject to the same compliance standards and requirements as standard hollow metal frames. Tested for thermal performance in accordance with NFRC 102, and resistance to air infiltration in accordance with NFRC 400. Where indicated provide thermally broken frame profiles available for use in both masonry and drywall construction. Fabricate with 1/16” positive thermal break and integral vinyl weatherstripping.

C. Exterior Frames: Fabricated of hot-dipped zinc coated steel that complies with ASTM A 653/A 653M, Coating Designation A60.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 14 gauge (0.067-inch -1.7-mm) thick steel sheet.
3. Manufacturers Basis of Design:

    a. Ceco Company – SU Series.

D. Interior Frames: Fabricated from cold-rolled steel sheet that complies with ASTM A 1008/A 1008M.

1. Fabricate frames with mitered or coped corners. Profile as indicated on drawings.
2. Frames: Minimum 16 gauge (0.053-inch -1.3-mm) thick steel sheet.
3. Manufacturers Basis of Design:

a. Ceco Company - SU Series.

E. Fire rated frames: Fabricate frames in accordance with NFPA 80, listed and labeled by a qualified testing agency, for fire-protection ratings indicated.

F. Hardware Reinforcement: Fabricate according to ANSI/SDI A250.6 Table 4 with reinforcement plates from same material as frames.

2.5 FRAME ANCHORS

A. Jamb Anchors:

1. Masonry Type: Adjustable strap-and-stirrup or T-shaped anchors to suit frame size, formed from A60 metallic coated material, not less than 0.042 inch thick, with corrugated or perforated straps not less than 2 inches wide by 10 inches long; or wire anchors not less than 0.177 inch thick.
2. Stud Wall Type: Designed to engage stud and not less than 0.042 inch thick.
3. Compression Type for Drywall Slip-on (Knock-Down) Frames: Adjustable compression anchors.

B. Floor Anchors: Floor anchors to be provided at each jamb, formed from A60 metallic coated material, not less than 0.042 inches thick.

C. Mortar Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.6 LOUVERS

A. Metal Louvers: Unless otherwise indicated provide louvers to meet the following requirements.

1. Blade Type: Vision proof inverted V or inverted Y.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

B. Louvers for Fire Rated Doors: Metal louvers with fusible link and closing device, listed and labeled for use in doors with fire protection rating of 1-1/2 hours and less.

1. Manufacturers: Subject to compliance with requirements, provide louvers to meet rating indicated.
2. Metal and Finish: Galvanized steel, 0.040 inch thick, factory primed for paint finish with baked enamel or powder coated finish. Match pre-finished door paint color where applicable.

2.7 LIGHT OPENINGS AND GLAZING

A. Stops and Moldings: Provide stops and moldings around glazed lites where indicated. Form corners of stops and moldings with butted or mitered hairline joints at fabricator's shop. Fixed and removable stops to allow multiple glazed lites each to be removed independently. Coordinate frame rabbet widths between fixed and removable stops with the type of glazing and installation indicated.

B. Moldings for Glazed Lites in Doors and Loose Stops for Glazed Lites in Frames: Minimum 20 gauge thick, fabricated from same material as door face sheet in which they are installed.

C. Fixed Frame Moldings: Formed integral with hollow metal frames, a minimum of 5/8 inch (16 mm) high unless otherwise indicated. Provide fixed frame moldings and stops on outside of exterior and on secure side of interior doors and frames.

D. Preformed Metal Frames for Light Openings: Manufacturer's standard frame formed of 0.048-inch-thick, cold rolled steel sheet; with baked enamel or powder coated finish; and approved for use in doors of fire protection rating indicated. Match pre-finished door paint color where applicable.

2.8 ACCESSORIES

A. Mullions and Transom Bars: Join to adjacent members by welding or rigid mechanical anchors.

B. Grout Guards: Formed from same material as frames, not less than 0.016 inches thick.

2.9 FABRICATION

A. Fabricate hollow metal work to be rigid and free of defects, warp, or buckle. Accurately form metal to required sizes and profiles, with minimum radius for thickness of metal. Where practical, fit and assemble units in manufacturer's plant. When shipping limitations so dictate, frames for large openings are to be fabricated in sections for splicing or splining in the field by others.

B. Tolerances: Fabricate hollow metal work to tolerances indicated in ANSI/SDI A250.8.

C. Hollow Metal Doors:

1. Exterior Doors: Provide optional weep-hole openings in bottom of exterior doors to permit moisture to escape where specified.
2. Glazed Lites: Factory cut openings in doors with applied trim or kits to fit. Factory install glazing where indicated.
3. Astragals: Provide overlapping astragals as noted in door hardware sets in Division 08 Section "Door Hardware" on one leaf of pairs of doors where required by NFPA 80 for fire-performance rating or where indicated. Extend minimum 3/4 inch beyond edge of door on which astragal is mounted.
4. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge strap for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".

D. Hollow Metal Frames:

1. Shipping Limitations: Where frames are fabricated in sections due to shipping or handling limitations, provide alignment plates or angles at each joint, fabricated of same thickness metal as frames.
2. Welded Frames: Weld flush face joints continuously; grind, fill, dress, and make smooth, flush, and invisible.

    a. Welded frames are to be provided with two steel spreaders temporarily attached to the bottom of both jambs to serve as a brace during shipping and handling. Spreader bars are for bracing only and are not to be used to size the frame opening.

3. Sidelight and Transom Bar Frames: Provide closed tubular members with no visible face seams or joints, fabricated from same material as door frame. Fasten members at crossings and to jambs by butt welding.
4. High Frequency Hinge Reinforcement: Provide high frequency hinge reinforcements at door openings 48-inches and wider with mortise butt type hinges at top hinge locations.
5. Continuous Hinge Reinforcement: Provide welded continuous 12 gauge straps for continuous hinges specified in hardware sets in Division 08 Section "Door Hardware".
6. Provide countersunk, flat- or oval-head exposed screws and bolts for exposed fasteners unless otherwise indicated for removable stops, provide security screws at exterior locations.
7. Mortar Guards: Provide guard boxes at back of hardware mortises in frames at all hinges and strike preps regardless of grouting requirements.
8. Floor Anchors: Weld anchors to bottom of jambs and mullions with at least four spot welds per anchor.
9. Jamb Anchors: Provide number and spacing of anchors as follows:

    a. Masonry Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Two anchors per jamb up to 60 inches high.
        2) Three anchors per jamb from 60 to 90 inches high.
        3) Four anchors per jamb from 90 to 120 inches high.
        4) Four anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 120 inches high.

    b. Stud Wall Type: Locate anchors not more than 18 inches from top and bottom of frame. Space anchors not more than 32 inches o.c. and as follows:

        1) Three anchors per jamb up to 60 inches high.
        2) Four anchors per jamb from 60 to 90 inches high.
        3) Five anchors per jamb from 90 to 96 inches high.
        4) Five anchors per jamb plus 1 additional anchor per jamb for each 24 inches or fraction thereof above 96 inches high.
        5) Two anchors per head for frames above 42 inches wide and mounted in metal stud partitions.
10. Door Silencers: Except on weatherstripped or gasketed doors, drill stops to receive door silencers. Silencers to be supplied by frame manufacturer regardless if specified in Division 08 Section "Door Hardware".
11. Bituminous Coating: Where frames are fully grouted with an approved Portland Cement based grout or mortar, coat inside of frame throat with a water based bituminous or asphaltic emulsion coating to a minimum thickness of 3 mils DFT, tested in accordance

with UL 10C and applied to the frame under a 3rd party independent follow-up service procedure.

E. Hardware Preparation: Factory prepare hollow metal work to receive template mortised hardware; include cutouts, reinforcement, mortising, drilling, and tapping according to the Door Hardware Schedule and templates furnished as specified in Division 08 Section "Door Hardware."

1. Locate hardware as indicated, or if not indicated, according to ANSI/SDI A250.8.
2. Reinforce doors and frames to receive non-template, mortised and surface mounted door hardware.
3. Comply with applicable requirements in ANSI/SDI A250.6 and ANSI/DHI A115 Series specifications for preparation of hollow metal work for hardware.
4. Coordinate locations of conduit and wiring boxes for electrical connections with Division 26 Sections.

2.10 STEEL FINISHES

A. Prime Finishes: Doors and frames to be cleaned, and chemically treated to insure maximum finish paint adhesion. Surfaces of the door and frame exposed to view to receive a factory applied coat of rust inhibiting shop primer.

1. Shop Primer: Manufacturer's standard, fast-curing, lead and chromate free primer complying with ANSI/SDI A250.10 acceptance criteria; recommended by primer manufacturer for substrate; and compatible with substrate and field-applied coatings.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine substrates, areas, and conditions, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of the Work.

B. General Contractor to verify the accuracy of dimensions given to the steel door and frame manufacturer for existing openings or existing frames (strike height, hinge spacing, hinge back set, etc.).

C. Proceed with installation only after unsatisfactory conditions have been corrected.

3.2 PREPARATION

A. Remove welded in shipping spreaders installed at factory. Restore exposed finish by grinding, filling, and dressing, as required to make repaired area smooth, flush, and invisible on exposed faces.

B. Prior to installation, adjust and securely brace welded hollow metal frames for square, level, twist, and plumb condition.

C. Tolerances shall comply with SDI-117 "Manufacturing Tolerances Standard Steel Doors and Frames."

D. Drill and tap doors and frames to receive non-template, mortised, and surface-mounted door hardware.

3.3 INSTALLATION

A. General: Install hollow metal work plumb, rigid, properly aligned, and securely fastened in place; comply with Drawings and manufacturer's written instructions.

B. Hollow Metal Frames: Install hollow metal frames of size and profile indicated. Comply with ANSI/SDI A250.11 and NFPA 80 at fire rated openings.

1. Set frames accurately in position, plumbed, leveled, aligned, and braced securely until permanent anchors are set. After wall construction is complete and frames properly set and secured, remove temporary braces, leaving surfaces smooth and undamaged. Shim as necessary to comply with installation tolerances.
2. Floor Anchors: Provide floor anchors for each jamb and mullion that extends to floor, and secure with post-installed expansion anchors.
3. Masonry Walls: Coordinate installation of frames to allow for solidly filling space between frames and masonry with mortar.
4. Grout Requirements: Do not grout head of frames unless reinforcing has been installed in head of frame. Do not grout vertical or horizontal closed mullion members.

C. Hollow Metal Doors: Fit hollow metal doors accurately in frames, within clearances specified below. Shim as necessary.

1. Non-Fire-Rated Standard Steel Doors:

a. Jambs and Head: 1/8 inch plus or minus 1/16 inch.
b. Between Edges of Pairs of Doors: 1/8 inch plus or minus 1/16 inch.
c. Between Bottom of Door and Top of Threshold: Maximum 3/8 inch.
d. Between Bottom of Door and Top of Finish Floor (No Threshold): Maximum 3/4 inch.

2. Fire-Rated Doors: Install doors with clearances according to NFPA 80.

D. Field Glazing: Comply with installation requirements in Division 08 Section "Glazing" and with hollow metal manufacturer's written instructions.

3.4 ADJUSTING AND CLEANING

A. Final Adjustments: Check and readjust operating hardware items immediately before final inspection. Leave work in complete and proper operating condition. Remove and replace defective work, including hollow metal work that is warped, bowed, or otherwise unacceptable.

B. Remove grout and other bonding material from hollow metal work immediately after installation.

C. Prime-Coat and Painted Finish Touchup: Immediately after erection, sand smooth rusted or damaged areas of prime coat, or painted finishes, and apply touchup of compatible air drying, rust-inhibitive primer, zinc rich primer (exterior and galvanized openings) or finish paint.

3.5 FIELD QUALITY CONTROL

A. Field Inspection (Punch Report): Reference Division 01 Sections “Closeout Procedures”. Produce project punch report for each installed door opening indicating compliance with approved submittals and verification hardware is properly installed, operating and adjusted. Include list of items to be completed and corrected, indicating the reasons or deficiencies causing the Work to be incomplete or rejected.

1. Organization of List: Include separate Door Opening and Deficiencies and Corrective Action Lists organized by Mark, Opening Remarks and Comments, and related Opening Images and Video Recordings.

END OF SECTION 081113

SECTION 081416
FLUSH WOOD DOORS

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Solid-core doors with wood-veneer faces.
2. Factory finishing flush wood doors.
3. Factory fitting flush wood doors to frames and factory machining for hardware.

B. Related Sections:

1. Section 088000 "Glazing" for glass view panels in flush wood doors.

1.2 SUBMITTALS

A. Product Data: For each type of door indicated. Include factory-finishing specifications.

B. Shop Drawings: Indicate location, size, and hand of each door; elevation of each kind of door; construction details not covered in Product Data; location and extent of hardware blocking; and other pertinent data.

1. Indicate dimensions and locations of mortises and holes for hardware.
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-protection ratings for fire-rated doors.

C. Samples: For factory-finished doors.

1.3 QUALITY ASSURANCE

A. Manufacturer Qualifications: A qualified manufacturer that is certified for chain of custody by an FSC-accredited certification body.

B. Quality Standard: In addition to requirements specified, comply with AWI's "Architectural Woodwork Quality Standards Illustrated."

C. Fire-Rated Wood Doors: Doors complying with NFPA 80 that are listed and labeled by a qualified testing agency, for fire-protection ratings indicated, based on testing at positive pressure according to NFPA 252 or UL 10C.

PART 2 - PRODUCTS
PART 3 - EXECUTION

3.1 INSTALLATION

A. Hardware: For installation, see Section 087100 "Door Hardware."

B. Installation Instructions: Install doors to comply with manufacturer's written instructions and the referenced quality standard, and as indicated.

1. Install fire-rated doors in corresponding fire-rated frames according to NFPA 80.

C. Job-Fitted Doors: Align and fit doors in frames with uniform clearances and bevels; do not trim stiles and rails in excess of limits set by manufacturer or permitted for fire-rated doors. Machine doors for hardware. Seal edges of doors, edges of cutouts, and mortises after fitting and machining.

1. Clearances: Provide **1/8 inch** at heads, jambs, and between pairs of doors. Provide **1/8 inch** from bottom of door to top of decorative floor finish or covering unless otherwise indicated. Where threshold is shown or scheduled, provide **1/4 inch** from bottom of door to top of threshold unless otherwise indicated.

a. Comply with NFPA 80 for fire-rated doors.

D. Factory-Fitted Doors: Align in frames for uniform clearance at each edge.

E. Factory-Finished Doors: Restore finish before installation if fitting or machining is required at Project site.

END OF SECTION 081416

SECTION 081433
STILE AND RAIL WOOD DOORS

PART 2 PRODUCTS

1.01 DOORS

1.02 DOOR AND PANEL FACINGS

A. Adhesive: Type I - Waterproof.

1.03 DOOR CONSTRUCTION

END OF SECTION

SECTION 083463 - SECURITY HOLLOW METAL DOORS AND FRAMES

PART 1 - GENERAL

1.01 GENERAL

A. The products specified in this section shall be coordinated with Section 087163, SECURITY HARDWARE and Section 088853, SECURITY GLASS AND GLAZING. All security doors and frames shall be fabricated by the same manufacturer.

B. This section includes requirements for security hollow metal doors, door frames, side lights, borrowed lights, window walls, and related items of work necessary for a complete facility in accordance with the contract documents. It includes furnishing and supervising installation of security hollow metal doors and frames of all types indicated as "SHM" or with hardware designations of "SH". Furnishing only, and timely delivery to the location designated, all embedded anchor bars and other shapes as indicated on plans and called for in this section as required to firmly anchor all devices and miscellaneous security framing to concrete or masonry work.

C. Acceptable Manufacturers: Except as otherwise specified herein the equipment and materials of this section shall be products of the following manufacturers, subject, however, to compliance with specifications requirements:
1. Noah Detention, FL
2. U.S. Security, AL
3. Cornerstone Detention Equipment, Tanner, AL
4. Willo Products, AL
5. Habersham Metal Products Co., GA
6. American Steel, GA

1.02 APPLICABLE PUBLICATIONS

The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. American Society of Testing Materials (ASTM):

A 366-72	Steel, Carbon, Cold-Rolled Sheet, Commercial Quality (R 1979)
A 526-80	Steel Sheet, Zinc-Coated (Galvanized) by the Hot-Dip process, Commercial Quality
A 569-72	Steel, Carbon (0.15 maximum, percent), Hot-Rolled(R 1979)Sheet and Strip, Commercial Quality
B-117073	Methods of Salt Spray Fog Testing (R 1979)
D-1735	Water Fog Test for Organic Coatings
G 60-79	Conducting Cyclic Humidity Tests

B. National Association of Architectural Metal Manufacturers (NAAMM):

CHM-1-74	Recommended Architectural Specifications for Custom Hollow Metal Doors and Frames

1.03 SUBMITTALS

A. Submit shop drawings before fabrication showing erection construction and requirements not

fully described by manufacturer's data. Include plans and elevations at not less than 3/8" to 1'-0" scale and details at not less than 3" to 1'-0" scale. Indicate required anchorage and accessory items, field dimensions and finishes. Shop drawings for doors and frames shall come from the same manufacturer. Provide a schedule listing the location in the building of each door and frame using indicated reference numbers for details and openings shown in the contract documents. Shop drawings shall be submitted "in person" by the Contractor and manufacturer in the Owners office.

B. Submit copies of manufacturers' material and fabrication specification and installation instructions modified to reflect project requirements and job conditions. Include instructions for handling, storage, and protection of each product.

C. Other security hollow metal door manufacturers requesting approval as an acceptable manufacturer shall submit to the Architect 10 days prior to the bid opening, an independent testing laboratory report stamped by a registered professional engineer certifying the following minimum performance of a typical flush prison door:
Test "A" - Static Load: Under centrally applied load of 14,000 pounds (660 lbs. per square foot) at quarter points the maximum permitted deflection of 0.58" with a rebound of 0.015" after release of load.
Test "B" - Rack Test: Under a concentrated load of 7,500 lbs. on one unsupported corner of door, the maximum deflection shall not exceed 3.5" without failure.

1.04 DELIVERY AND STORAGE

A. Deliver security hollow metal doors, frames, and related items cartoned for protection.

B. Doors and frames shall have their wrappings or coverings removed upon delivery to the building site.

C. Store all materials in a dry covered area.

D. It shall be the responsibility of the Contractor to promptly clean and touch up with a rust inhibitive primer any scratches or disfigurement caused in shipping or handling.

E. Place all materials on planking or blocking, at least 4" off of the ground, 2" off of a paved area or floor slab.

F. Do not store flat: Store doors and frames in an upright position with heads upper most.

G. Place no more than 5 single opening frames or 3 multi-opening frames in a group.

H. Provide, by means of wood strips, a space of at least 1/4" between all units to permit air circulation.

1.05 COORDINATION WITH OTHER WORK

A. The security hollow metal doors, door frames, and frames, Contractor shall coordinate installation with SECURITY HARDWARE and SECURITY GLASS AND GLAZING.

B. If there are any problems with fire labelling of openings shall be presented to the Architect at least 5 days prior to bid.

1.06 FIRE RATED DOORS AND FRAMES

A. The Contractor shall be responsible to make sure that all fire rated doors, frames and hardware that require a U.L. label can be labelled. If any door assembly cannot be labeled, the contractor must notify the architect with 10 days prior to bid day.

PART 2 - PRODUCTS

2.01 MATERIALS - SECURITY HOLLOW METAL FRAMES

A. Frames shall be combination type with integral trim fabricated of cold rolled, or hot rolled, pickled and oiled steel sheets with clean, smooth surfaces. Joints shall be of full welded unit type construction with contact edges closed tight and welds on exposed surfaces depressed smooth and flush. Fabricate molded members straight and true, with corner joints well formed and in true alignment and fastenings concealed where practicable. Finish work shall be strong, rigid, neat in appearance, and free of defects. Frames specified on the drawings as galvanized shall be zinc coated carbon steel sheet in accordance with ASTM A526 and tested by ASTM G60, mill phosphatized.

B. Exterior and Interior Frames: Frames for exterior openings shall be made of commercial grade GALVANIZED OR GALVANEAL steel conforming to ASTM A366-72. Metal thickness for frames shall be as indicated on plans. Interior frames for interior openings shall be either commercial grade cold rolled steel conforming to ASTM designation A366-72 or commercial grade hot rolled and pickled steel conforming to ASTM designation A569-72. Metal thickness shall not be less than specified for exterior opening. Frames shall have fully mitered joints, including stops, and shall be continuously welded inside the miter across the full depth and width of the frame. Mullions, jambs, head, and sill shall be secured to walls and fully grouted.

C. Frames for Multiple or Special Openings: Shall have mullion and/or rail members which are closed tubular shapes, having no visible seams or joints on the faces. All joints between faces of abutting members shall be securely welded and finished smooth. Mullions, jambs, head, and sill shall be secured to walls and fully grouted.

D. Fabrication: Frames shall be shipped as a complete unit where possible. When shipping limitations so dictate. Frames for large openings shall be fabricated in smaller sections and designed for splicing in the field; factory prepared splices shall be field assembled.

E. Reinforcing: Frames shall be mortised, reinforced, drilled, and tapped at the factory for templated mortised hardware in accordance with the approved hardware schedules and templated provided by the subcontractor for this section. Where surface mounted hardware is to be applied, frames shall have reinforcing plates completely drilled and tapped for installation in the field.

F. Hinge Reinforcing: For mortise butts, provide a 7 gauge minimum x 1-1/2" x 10" long reinforcing plate, offset at each hinge location and factory drilled and tapped. A 12 gauge by 1-1/2" x 1-1/2" x 2" long angle reinforcement shall be welded in place between the center of the reinforcement and the inside trim face of the frame to prevent deformation of the hinge reinforcement and the inside trim face of the frame to prevent deformation of the hinge reinforcement under door load. A mortar guard shall be welded in place on the back of the reinforcement, and filled with a urethane foam to prevent grout from entering the screw holes

prior to hardware installation.

G. Lock or Keeper Provisions: Lock or keeper preparation shall be in accordance with the recommendation of the hardware manufacturers. Reinforcements shall be not less than 7 gauge steel. All cutouts and reinforcements shall be protected with pressed steel mortar guards on the inside of the frame.

H. Floor Anchors: Shall be formed of not less than 12 gauge steel and shall be securely welded at the bottom of each jamb. Where so scheduled or specified, adjustable floor anchors extending down to below the finish floor and providing not less than 2" height adjustment shall be provided.

I. Anchor in Masonry: Frames for installation in masonry walls shall be provided with adjustable jamb anchors of the strap and stirrup type made from the same gauge steel as frame. Strap shall be no less than 2" x 10" in size, corrugated and/or perforated. The number of anchors provided on each jamb shall be as follows:

Frames up to 7'6" height - 4
Frames from 7'6" to 8'0" height - 5
Frames over 8'0" height - 1 anchor for each 16" or fraction thereof

J. Stiffeners: All frames shall be provided with steel spreader angles, temporarily attached to the bottom of both jambs, one on each side of the opening to serve as a brace during shipping and handling. The steel spreaders shall be removed by the Contractor prior to setting frames.

K. Removable Security Glazing Stops: The removable glass stop shall consist of 10 gauge angle securely fastened to the frame using machine screws 1/4-28 or 1/4-20, 6 inches on center, a minimum of 3 inches from the corners. All exposed screw heads shall be round, pan, or oval type, Torx drive, tamperproof. The finished glassstop shall be tight fitting and mitered at the corner joints. Mortar guards covering the glass stop screws shall be installed on all masonry grouted frames. There shall be a minimum of 1" glass engagement.

L. Finish: After fabrication, all tool marks and surface imperfections shall be removed and exposed faces of all welded joints shall be dressed smooth. Frames shall be chemically treated to insure maximum painted adhesion and shall be coated on all accessible surfaces with a rust inhibitive primer which meets or exceeds ASTM designation B-117, salt spray for 150 hours, and ASTM designation D-1735 water fog test for organic coatings for 200 hours, and which is fully cured prior to shipment.

M. All security hollow metal frames shall be 12 gauge steel unless otherwise noted.

N. All maximum cell frames and door shall be 12 guage steel.

O. Any door and frame and accessories located within inmate areas shall have stainless steel torx head with center pin security screws.

P. Provide two (2) floor stops per new door. Door stops shall be Rockwood 467 Heavy Duty Door Stop, 3-1/2” in Height, 2” width. Grainger Model number #20KA60. Color Black, 5/8”x2-1/2” Mounting Bolt, Stainless Steel.

2.02 MATERIALS - SECURITY HOLLOW METAL DOORS

A. Doors shall be of types, sizes, and designs noted, fabricated of cold rolled, picked and oiled stretcher leveled steel sheets with clean, smooth surfaces. Metal thickness for doors shall be as indicated on the drawings. Phosphate treat metal prior to painting. Finished work shall be rigid, neat in appearance, and free of defects. Form molded members straight and true, with joints copes or mitered, well formed, and in true alignment. Welded joints on exposed surfaces shall be dressed smooth, to be invisible. Doors specified as galvanized shall be zinc coated carbon steel sheet in accordance with ASTM A526 and tested by ASTM G60, mill phosphatized.

B. Door Faces: Shall be of commercial quality leveled cold rolled steel conforming to ASTM designation A366-72 or hot rolled pickled and oiled steel conforming to ASTM designation A569-72 and shall be free of scale, pitting or other surface defects. All security hollow metal doors shall be as indicated on plans.
All doors shall be custom made full flush design, internally reinforced, sound deadened, insulated, and thickness as indicated on the drawings. Doors shall receive security hardware of the types and sizes shown on the approved shop drawings and schedules. Note: Manufacturer shall coordinate frame dimensions to thickness of door.

C. Appearance: All doors shall be strong, rigid, and neat in appearance, free from warpage, wind, or buckle. All bends shall be true and straight and of minimum radius of the gauge of metal used.

D. Construction: Doors shall have mild steel face sheets continuously welded on edges and finished smooth so that there are no visible seams. The door shall be stiffened by continuous vertical formed steel sections which, upon assembly, shall span the full thickness of the interior space between door faces. The stiffener shall be 18 gauge minimum, spaced so that the vertical interior webs shall be no more than 4" OC and securely fastened to both face sheets by spotwelds spaced a maximum of 3" OC vertically. Spaces between stiffeners shall be filled with fiberglass or mineral rock wool batt type material.

E. Edges: Vertical door edges shall be beveled 1/8" in 2" and shall be reinforced by a continuous steel channel, not less than 10 gauge, extending the full length of the door welded not more than 3" on center inside he door faces. Top and bottom door edges shall be closed with continuous recessed 10 gauge channels extending the full width of the door and welded 3" on center maximum to both faces and continuously welded to the vertical door edge channels to form a single perimeter frame inside the door.

F. Closer Channel: The top end channel shall be fitted with an additional flush closing channel of not less than 16 gauge. The flush closing channel shall be welded in place at the corners and at the center. Installation of the closer channel using screws, security or otherwise, shall be deemed unacceptable. The end channel and flush closer channel shall be installed so that they are permanent and non-removable.

G. Door Edges: Shall be mortised and accurately cut, reinforced, drilled, and tapped to receive templated mortised hardware in accordance with the approved hardware schedule and the hardware manufacturer's recommendations for the proper installation of all hardware and prison equipment. Where surface mounted hardware is to be applied, the manufacturer shall provide reinforcement plates only, and drilling and tapping shall be done in the field by the hardware installer.

H. Removable Security Glazing Stops: The removable glazing stop shall consist of 10 gauge angle securely fastened to the frame using machine screws 1/4-28 or 1/4-20, 6 inches on center, a minimum of 3 inches from the corners. All exposed screw heads shall be round, pan, or oval type, and shall be Torx drive, tamperproof. The finished glass stop shall be tight fitting and mitered at the corner joints. Mortar guards covering the glass stop screws shall be installed on all masonry grouted frames. There shall be a minimum of 1" glass engagement.

I. Finish: After fabrication, all tool marks and surface blemishes shall be filled and sanded as required to make both faces and both vertical edges smooth and free of irregularities. After appropriate preparation, all exposed surfaces shall receive 2 shop coats of rust inhibitive primer which meets or exceeds ASTM designation B-117, salt spray for 150 hours ASTM designation D-1735, water fog test for organic coatings for 200 hours, and which is fully cured prior to shipment.

J. All security hollow metal doors shall be 12 gauge steel.

K. All maximum cell doors shall be 12 gauge steel.

L. Provide on all cell doors a lock protector. Lock protector shall be installed on inmate side and shall be manufactured by Glynn-Johnson LPI thru LP6 as required.

PART 3 - EXECUTION

3.01 CLEANING AND PAINTING

A. Upon completion of installation, surfaces of doors and frames which have been completely factory finished shall be thoroughly cleaned and touched up, as recommended by door manufacturer.

3.02 INSTALLATION

A. Upon direction of the Architect, the Contractor shall destroy a randomly selected security hollow metal door or panel by sawing it in half. Should examination disclose door construction at variance with the details specified, the door manufacturer shall, upon direction of the Architect, replace all doors shipped to the project as of the date of inspection with doors conforming to the specifications. Under conditions of non-conformity, the door manufacturer shall pay for the destroyed door and related labor. Should examination prove that the door was constructed in conformance with specifications, the Owner will pay to replace the destroyed door and related labor.

B. The Contractor shall submit in writing verification that the frames are set plumb and true prior to erection of masonry walls and then again following wall construction. The frames and doors will not be accepted unless the verifications have been properly submitted and approved. The Contractor shall install frames in strict accordance with the following tolerances:

Plumbness:	$\pm$ 1/16"
Squareness:	$\pm$ 1/16"
Alignment:	$\pm$ 1/16"
Twist:	$\pm$ 1/16"

Plumbness, squareness, alignment, and twist methods of measurements are defined in NAAMM, CHM-1-74.

C. The location of hardware on doors and frames shall be as follows:

Hinges: Top	-	5" from head of frame to top of hinge
Bottom	-	10" from finished floor to bottom of hinge
Intermediate	-	centered between top and bottom hinges
On Dutch Doors	-	5" from head of frame to top of hinge
	-	10" from finished floor to bottom of bottom hinge
	-	5" from split line to top and bottom respectively of lower and upper intermediate hinges
Unit and integral		
Type locks and latches	-	38" to centerline of knob
Deadlocks	-	60" to centerline of cylinder
Panic hardware	-	38" to centerline of cross bar
Door pulls	-	42" to center of grip
Push-pull bars	-	42" to centerline of bar (from finished floor)
Arm pulls	-	48" to centerline of plate
Roller latches	-	45" to centerline

D. Edge clearance shall be provided as follows:
Between doors and frame, at head and jambs 1/8"
At door sills: where no threshold is used 3/8" maximum where threshold is used 3/4" max. above finished floor
Between meeting edges of pairs of doors 1/8"
Finished floor is defined as the top surface of the floor, except when resilient tile or carpet is used, when it is the top of the concrete slab. Where the carpet is more than 1/2" thick, allow 1/4" clearance.

E. It shall be the responsibility of the Contractor to provide hinge shims and make adjustments as necessary to provide clearances a required. Methods of adjustment shall be as recommended and defined by NAAMM CHM-1-74.

F. Mullions, jambs, head, and sill of frames shall be secured to walls and fully grouted.

G. The security hollow metal manufacturer shall coordinate with the security hardware manufacturer to insure proper operation of door frame and lock function.

END OF SECTION
THCLLC - January 16, 2025

SECTION 084313
ALUMINUM-FRAMED STOREFRONTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Aluminum-framed storefront, with vision glass.

B. Aluminum doors and frames.

C. Weatherstripping.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between frames and adjacent construction.

B. Section 087100 - Door Hardware: Hardware items other than specified in this section.

1.03 REFERENCE STANDARDS

A. AAMA CW-10 - Care and Handling of Architectural Aluminum from Shop to Site; 2015.

B. AAMA 611 - Specification for Anodized Architectural Aluminum; 2024.

C. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2021.

D. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2021.

E. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

F. ASTM E330/E330M - Standard Test Method for Structural Performance of Exterior Windows, Doors, Skylights and Curtain Walls by Uniform Static Air Pressure Difference; 2014 (Reapproved 2021).

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide component dimensions, describe components within assembly, anchorage and fasteners, glass and infill, door hardware, and internal drainage details.

C. Shop Drawings: Indicate system dimensions, framed opening requirements and tolerances, affected related work, expansion and contraction joint location and details, and field welding required.

1. Include design engineer's stamp or seal on shop drawings for attachments and anchors.

1.05 QUALITY ASSURANCE

A. Designer Qualifications: Design structural support framing components under direct supervision of a Professional Structural Engineer experienced in design of this Work and licensed in the State in which the Project is located.

B. Manufacturer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

C. Installer Qualifications: Company specializing in performing work of type specified and with at least three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Handle products of this section in accordance with AAMA CW-10.

B. Protect finished aluminum surfaces with wrapping. Do not use adhesive papers or sprayed coatings that bond to aluminum when exposed to sunlight or weather.

1.07 FIELD CONDITIONS

A. Do not install sealants when ambient temperature is less than 40 degrees F (5 degrees C). Maintain this minimum temperature during and 48 hours after installation.

1.08 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Correct defective Work within a five year period after Date of Substantial Completion.

C. Provide five year manufacturer warranty against failure of glass seal on insulating glass units, including interpane dusting or misting. Include provision for replacement of failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Aluminum-Framed Storefronts:
   1. Kawneer North America; _____: www.kawneer.com/#sle.
   2. Oldcastle BuildingEnvelope; _____: www.oldcastlebe.com/#sle.
   3. Trulite Glass & Aluminum Solutions, LLC; _____: www.trulite.com/#sle.
   4. YKK AP America, Inc; _____: www.ykkap.com/commercial/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

2.02 BASIS OF DESIGN -- FRAMING FOR INSULATING GLAZING

A. Center-Set Style, Not Thermally-Broken:
   1. Vertical Mullion Dimensions: 2 inches wide by 4-1/2 inches deep (50 mm wide by 114 mm deep).

2.03 BASIS OF DESIGN -- SWINGING DOORS

A. Narrow Stile, Insulating Glazing, Thermally-Broken:
   1. Thickness: 1-3/4 inches (43 mm).

B. Substitutions: See Section 016000 - Product Requirements.
   1. For any product not identified as "Basis of Design", submit information as specified for substitutions.

2.04 ALUMINUM-FRAMED STOREFRONT

A. Aluminum-Framed Storefront: Factory fabricated, factory finished aluminum framing members with infill, and related flashings, anchorage and attachment devices.
   1. Glazing Rabbet: For 1 inch (25 mm) insulating glazing.
   2. Finish: Class II color anodized.
      a. Factory finish all surfaces that will be exposed in completed assemblies.
   3. Finish Color: As selected by Architect from manufacturer's standard line.
   4. Fabrication: Joints and corners flush, hairline, and weatherproof, accurately fitted and secured; prepared to receive anchors and hardware; fasteners and attachments concealed from view; reinforced as required for imposed loads.
   5. Construction: Eliminate noises caused by wind and thermal movement, prevent vibration harmonics, and prevent "stack effect" in internal spaces.
   6. System Internal Drainage: Drain to the exterior by means of a weep drainage network any water entering joints, condensation occurring in glazing channel, and migrating moisture occurring within system.
   7. Expansion/Contraction: Provide for expansion and contraction within system components caused by cycling temperature range of 170 degrees F (95 degrees C) over a 12 hour period without causing detrimental effect to system components, anchorages, and other building elements.
   8. Movement: Allow for movement between storefront and adjacent construction, without damage to components or deterioration of seals.
   9. Perimeter Clearance: Minimize space between framing members and adjacent construction while allowing expected movement.

B. Performance Requirements
   1. Wind Loads: Design and size components to withstand the specified load requirements without damage or permanent set, when tested in accordance with ASTM E330/E330M, using loads 1.5 times the design wind loads and 10 second duration of maximum load.
      a. Member Deflection: Limit member deflection to flexure limit of glass in any direction, with full recovery of glazing materials.
   2. Air Leakage: 0.06 cfm/sq ft (0.3 L/sec sq m) maximum leakage of storefront wall area when tested in accordance with ASTM E283/E283M at 1.57 psf (75 Pa) pressure difference.

2.05 COMPONENTS

A. Aluminum Framing Members: Tubular aluminum sections, thermally broken with interior section insulated from exterior, drainage holes and internal weep drainage system.
   1. Glazing Stops: Flush.

B. Swing Doors: Glazed aluminum.
   1. Thickness: 1-3/4 inches (43 mm).
   2. Top Rail: 4 inches (100 mm) wide.
   3. Bottom Rail: 10 inches (254 mm) wide.
   4. Glazing Stops: Square.

2.06 MATERIALS

A. Extruded Aluminum: ASTM B221 (ASTM B221M).

B. Fasteners: Stainless steel.

C. Glazing Gaskets: Type to suit application to achieve weather, moisture, and air infiltration requirements.

2.07 FINISHES

A. Class II Color Anodized Finish: AAMA 611 AA-M12C22A32 Integrally colored anodic coating not less than 0.4 mils (0.01 mm) thick.

2.08 HARDWARE

A. Other Door Hardware: See Section 087100.

B. Weatherstripping: Wool pile, continuous and replaceable; provide on all doors.

C. Sill Sweep Strips: Resilient seal type, retracting, of neoprene; provide on all doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify dimensions, tolerances, and method of attachment with other work.

B. Verify that storefront wall openings and adjoining water-resistive and/or air barrier seal materials are ready to receive work of this section.

3.02 INSTALLATION

A. Install wall system in accordance with manufacturer's instructions.

B. Attach to structure to permit sufficient adjustment to accommodate construction tolerances and other irregularities.

C. Provide alignment attachments and shims to permanently fasten system to building structure.

D. Align assembly plumb and level, free of warp or twist. Maintain assembly dimensional tolerances, aligning with adjacent work.

E. Provide thermal isolation where components penetrate or disrupt building insulation.

F. Install sill flashings. Turn up ends and edges; seal to adjacent work to form water tight dam.

G. Where fasteners penetrate sill flashings, make watertight by seating and sealing fastener heads to sill flashing.

H. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.

I. Touch-up minor damage to factory applied finish; replace components that cannot be satisfactorily repaired.

3.03 TOLERANCES

A. Maximum Variation from Plumb: 0.06 inch per 3 feet (1.5 mm per m) non-cumulative or 0.06 inch per 10 feet (1.5 mm per 3 m), whichever is less.

B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32 inch (0.8 mm).

3.04 ADJUSTING

A. Adjust operating hardware and sash for smooth operation.

3.05 CLEANING

A. Remove protective material from pre-finished aluminum surfaces.

B. Wash down surfaces with a solution of mild detergent in warm water, applied with soft, clean wiping cloths, and take care to remove dirt from corners and to wipe surfaces clean.

3.06 PROTECTION

A. Protect installed products from damage until Date of Substantial Completion.

END OF SECTION

SECTION 08 71 00
DOOR HARDWARE

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Hardware for fire-rated doors.

B. Electrically operated and controlled hardware.

C. Lock cylinders for doors with balance of hardware specified in other sections.

D. Smoke and draft control seals.

E. Weatherstripping and gasketing.

1.02 RELATED REQUIREMENTS

A. Section 06 20 00 - Finish Carpentry: Wood door frames.

B. Section 07 92 00 - Joint Sealants: Sealants for setting exterior door thresholds.

C. Section 08 11 13 - Hollow Metal Doors and Frames.

D. Section 08 11 16 - Aluminum Doors and Frames.

E. Section 08 14 16 - Flush Wood Doors.

F. Section 08 14 23 - Clad Wood Doors.

G. Section 08 43 13 - Aluminum-Framed Storefronts: Door hardware, except as noted in section.

H. Section 10 14 00 - Signage: Additional signage requirements.

I. Section 10 26 00 - Wall and Door Protection: Door and frame protection.

J. Section 28 10 00 - Access Control: Electronic access control devices.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM E283/E283M - Standard Test Method for Determining Rate of Air Leakage Through Exterior Windows, Skylights, Curtain Walls, and Doors Under Specified Pressure Differences Across the Specimen; 2019.

C. BHMA A156.1 - Standard for Butts and Hinges; 2021.

D. BHMA A156.3 - Exit Devices; 2020.

E. BHMA A156.4 - Door Controls - Closers; 2019.

F. BHMA A156.5 - Cylinders and Input Devices for Locks; 2020.

G. BHMA A156.6 - Standard for Architectural Door Trim; 2021.

H. BHMA A156.7 - Template Hinge Dimensions; 2016.

I. BHMA A156.13 - Mortise Locks & Latches Series 1000; 2022.

J. BHMA A156.16 - Auxiliary Hardware; 2018.

K. BHMA A156.18 - Materials and Finishes; 2020.

L. BHMA A156.22 - Standard for Gasketing; 2021.

M. BHMA A156.25 - Electrified Locking Devices; 2023.

N. BHMA A156.31 - Electric Strikes and Frame Mounted Actuators; 2019.

O. BHMA A156.115 - Hardware Preparation in Steel Doors and Steel Frames; 2016.

P. BHMA A156.115W - Hardware Preparation in Wood Doors with Wood or Steel Frames; 2006.

Q. DHI (H&S) - Sequence and Format for the Hardware Schedule; 2019.

R. DHI (LOCS) - Recommended Locations for Architectural Hardware for Standard Steel Doors and Frames; 2004.

S. DHI WDHS.3 - Recommended Locations for Architectural Hardware for Flush Wood Doors; 1993; also, in WDHS-1/WDHS-5 Series, 1996.

T. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

U. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

V. ISO 9001 - Quality Management Systems — Requirements; 2015.

W. ITS (DIR) - Directory of Listed Products; Current Edition.

X. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

Y. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2022.

Z. NFPA 101 - Life Safety Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

AA. NFPA 105 - Standard for Smoke Door Assemblies and Other Opening Protectives; 2022.

BB. NFPA 252 - Standard Methods of Fire Tests of Door Assemblies; 2022.

CC. UL (DIR) - Online Certifications Directory; Current Edition.

DD. UL 10C - Standard for Positive Pressure Fire Tests of Door Assemblies; Current Edition, Including All Revisions.

EE. UL 294 - Access Control System Units; Current Edition, Including All Revisions.

FF. UL 1034 - Standard for Safety Burglary-Resistant Electrical Locking Mechanisms; Current Edition, Including All Revisions.

GG. UL 1784 - Standard for Air Leakage Tests of Door Assemblies; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the manufacture, fabrication, and installation of products that door hardware is installed on.

B. Sequence installation to ensure facility services connections are achieved in an orderly and expeditious manner.

C. Preinstallation Meeting: Convene a preinstallation meeting one week prior to commencing work of this section; require attendance by affected installers and the following:
   1. Architect.
   2. Engineering Consultant
   3. Installer's Architectural Hardware Consultant (AHC).
   4. Hardware Installer.
   5. Owner's Security Consultant .

D. Furnish templates for door and frame preparation to manufacturers and fabricators of products requiring internal reinforcement for door hardware.

E. Keying Requirements Meeting:
   1. Attendance Required:
      a. Contractor.
      b. Owner.
      c. Installer's Architectural Hardware Consultant (AHC).
      d. Manufacturer Representative / Key System Consultant.
      e. Owner's Security Consultant (if applicable).
   2. Agenda:
      a. Establish keying requirements.
      b. Verify locksets and locking hardware are functionally correct for project requirements.
      c. Verify that keying and programming complies with project requirements.

d. Establish keying submittal schedule and update requirements.

3. Incorporate "Keying Requirements Meeting" decisions into keying submittal upon review of door hardware keying system including, but not limited to, the following:
   a. Access control requirements.
   b. Flow of traffic and extent of security required.
4. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect, Owner, participants, and those affected by decisions made.
5. Deliver established keying requirements to manufacturers.

1.05 SUBMITTALS

A. See Section 01 30 00 - Administrative Requirements for submittal procedures.

B. Product Data: Manufacturer's catalog literature for each type of hardware, marked to clearly show products to be furnished for this project, and includes construction details, material descriptions, finishes, and dimensions and profiles of individual components.

C. Shop Drawings - Door Hardware Schedule: A detailed listing that includes each item of hardware to be installed on each door.
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Comply with DHI (H&S) using door numbering scheme and hardware set numbers as indicated in Contract Documents.
      a. Submit in vertical format.
   3. Include complete description for each door listed.

D. Shop Drawings - Electrified Door Hardware: Include diagrams for power, signal, and control wiring for electrified door hardware that include details of interface with building safety and security systems. Provide elevations and diagrams for each electrified door opening as follows:
   1. Prepared by or under supervision of Architectural Hardware Consultant (AHC).
   2. Elevations: Include front and back elevations of each door opening showing electrified devices with connections installed and an operations narrative describing how opening operates from either side at any given time.

E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.

F. Manufacturer's qualification statement.

G. Installer's qualification statement.

H. Supplier's qualification statement.

I. Maintenance Data: Include data on operating hardware, lubrication requirements, and inspection procedures related to preventative maintenance.

J. Keying Schedule:
   1. Submit three (3) copies of Keying Schedule in compliance with requirements established during Keying Requirements Meeting unless otherwise indicated.

K. Warranty: Submit manufacturer's warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

L. Project Record Documents: Record actual locations of concealed equipment, services, and conduit.

M. Maintenance Materials and Tools: Furnish the following for Owner's use in maintenance of project.
   1. See Section 01 60 00 - Product Requirements, for additional provisions.
   2. Tools: One set of each special wrench or tool applicable for each different or special hardware component, whether supplied by hardware component manufacturer or not.

1.06 QUALITY ASSURANCE

A. Standards for Fire-Rated Doors: Maintain one copy of each referenced standard on site, for use by Architect and Contractor.

B. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section with minimum five years of documented experience.

C. Installer Qualifications: Company specializing in performing work of the type specified for commercial door hardware with at least five years of documented experience.

D. Supplier Qualifications: Company with certified Architectural Hardware Consultant (AHC) to assist in work of this section.

1.07 DELIVERY, STORAGE, AND HANDLING

A. Package hardware items individually; label and identify each package with door opening code to match door hardware schedule.

1.08 WARRANTY

A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

B. Manufacturer Warranty: Provide manufacturer warranty against defects in material and workmanship for period indicated, from Date of Substantial Completion. Complete forms in Owner's name and register with manufacturer.
   1. Closers: Thirty years, minimum.
   2. Exit Devices: Five years, minimum.
   3. Locksets and Cylinders: Five years, minimum.

PART 2 PRODUCTS

2.01 GENERAL REQUIREMENTS

A. Provide specified door hardware as required to make doors fully functional, compliant with applicable codes, and secure to extent indicated.

B. Provide individual items of single type, of same model, and by same manufacturer.

C. Locks: Provide a lock for each door, unless it is indicated that lock is not required.
   1. Lock Function: Provide lock and latch function numbers and descriptions of manufacturer's Series. As indicated in hardware sets.
   2. Trim: Provide lever handle or pull trim on outside of each lock, unless otherwise indicated.
   3. Strikes:
      a. Finish: To match lock or latch.
      b. Curved-Lip Strikes: Provide as standard, with extended lip to protect frame, unless otherwise indicated.
      c. Center Strike at Pairs of Doors: 7/8 inch flat lip.

D. Door Pulls and Push Plates:
   1. Provide door pulls and push plates on doors without a lockset, latch set, exit device, or auxiliary lock unless otherwise indicated.
   2. On solid doors, provide matching door pull and push plate on opposite faces.

E. Closers:
   1. Provide door closer on each exterior door, unless otherwise indicated.
   2. Provide door closer on each fire-rated and smoke-rated door.
   3. Spring hinges are not an acceptable self-closing device, unless otherwise indicated.

F. Drip Guards: Provide at head of out swinging exterior doors unless protected by roof or canopy directly overhead.

G. Thresholds:
   1. Interior Applications: Provide when specified at interior doors for transition between two different floor types, and over building expansion joints, unless otherwise indicated.
   2. Exterior Applications: Provide at each exterior door, unless otherwise indicated.

H. Smoke and Draft Control Seals:

1. Provide gasketing for smoke and draft control doors (Indicated as "S" on Drawings) that complies with local codes, requirements of assemblies tested in accordance with UL 1784.

I. Weatherstripping and Gasketing:
   1. Provide weatherstripping on each exterior door at head, jambs, and meeting stiles of door pairs, unless otherwise indicated.
   2. Provide door bottom sweep on each exterior door, unless otherwise indicated.

J. Electrically Operated and/or Controlled Hardware: Provide necessary power supplies, power transfer hinges, relays, and interfaces as required for proper operation; provide wiring between hardware and control components and to building power connection in compliance with NFPA 70.

K. See Section 28 10 00 for additional access control system requirements.

L. Fasteners:
   1. Provide fasteners of proper type, size, quantity, and finish that comply with commercially recognized standards for proposed applications.
      a. Aluminum fasteners are not permitted.
      b. Provide Phillips flat-head screws with heads finished to match door surface hardware unless otherwise indicated.
   2. Provide machine screws for attachment to reinforced hollow metal and aluminum frames.
      a. Self-drilling (Tek) type screws are not permitted.
   3. Provide stainless steel machine screws and lead expansion shields for concrete and masonry substrates.
   4. Provide wall grip inserts for hollow wall construction.
   5. Fire-Resistance-Rated Applications: Comply with NFPA 80.
      a. Provide wood or machine screws for hinges mortised to doors or frames, strike plates to frames, and closers to doors and frames.
      b. Provide steel through bolts for attachment of surface mounted closers, hinges, or exit devices to door panels unless proper door blocking is provided.

2.02 PERFORMANCE REQUIREMENTS

A. Provide door hardware products that comply with the following requirements:
   1. Applicable provisions of federal, state, and local codes.
      a. ICC (IBC).
   2. Accessibility: ADA Standards and ICC A117.1.
   3. Fire-Resistance-Rated Doors: NFPA 80, listed and labeled by qualified testing agency for fire protection ratings indicated, based on testing at positive pressure in accordance with NFPA 252 or UL 10C.
   4. Hardware on Fire-Resistance-Rated Doors: Listed and classified by UL (DIR) or ITS (DIR) as suitable for application indicated.
   5. Hardware for Smoke and Draft Control Doors (Indicated as "S" on Drawings): Provide door hardware that complies with local codes, and requirements of assemblies tested in accordance with UL 1784.
      a. Air Leakage Rate: Tested in accordance with UL 1784, with air leakage rate not to exceed 3.0 cfm/sf of door opening at 0.10 inch of water for both ambient and elevated temperature tests.
         1) When required for acceptance by authorities having jurisdiction for code-mandated applications, test without an artificial bottom seal.
   6. Hardware Preparation for Steel Doors and Steel Frames: BHMA A156.115.
   7. Hardware Preparation for Wood Doors with Wood or Steel Frames: BHMA A156.115W.
   8. Products Requiring Electrical Connection: Listed and classified by UL (DIR) as suitable for the purpose specified.

2.03 HINGES

A. Manufacturers: Conventional butt hinges.

1. BEST; dormakaba Group: www.bestaccess.com/#sle.
2. PBB.
3. McKinney.

B. Properties:
1. Butt Hinges: As applicable to each item specified.
a. Standard Weight Hinges: Minimum of two (2) permanently lubricated non-detachable bearings.
b. Heavy Weight Hinges: Minimum of four (4) permanently lubricated bearings on heavy weight hinges.
c. Template screw hole locations.
d. Bearing assembly installed after plating.
e. Bearings: Exposed fully hardened bearings.
f. Bearing Shells: Shapes consistent with barrels.
g. Pins: Easily seated, non-rising pins.
1) Fully plated hinge pins.
2) Non-Removable Pins: Slotted stainless steel screws.
h. UL 10C listed for fire-resistance-rated doors.

C. Sizes: See Door Hardware Schedule.
1. Hinge Widths: As required to clear surrounding trim.
2. Sufficient size to allow 180 degree swing of door.

D. Finishes: See Door Hardware Schedule.
1. Fully polished hinges; front, back, and barrel.

E. Grades:
1. Butt Hinges: Comply with BHMA A156.1 and BHMA A156.7 for templated hinges.

F. Material: Base metal as indicated for each item by BHMA material and finish designation.

G. Types:
1. Butt Hinges: Include full mortise hinges.

H. Quantities:
1. Butt Hinges: Three (3) hinges per leaves up to 90 inches in height. Add one (1) for each additional 30 inches in height or fraction thereof.
a. Hinge weight and size unless otherwise indicated in hardware sets:
1) For doors up to 36 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.134 inch and a minimum of 4-1/2 inches in height.
2) For doors from 36 inches wide up to 42 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.145 inch and a minimum of 4-1/2 inches in height.
3) For doors from 42 inches wide up to 48 inches wide and up to 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.
4) For doors greater than 1-3/4 inches thick provide hinges with a minimum thickness of 0.180 inch and a minimum of 5 inches in height.

I. Applications: At swinging doors.
1. Provide non-removable pins at out-swinging doors with locking hardware and all exterior doors.

J. Products:
1. Butt Hinges:
a. Ball Bearing, Five (5) Knuckle. FBB Series.

2.04 BOLTS

A. Manufacturers:
1. Trimco: www.trimcohardware.com/#sle.

2. ABH.
3. Rockwood.

B. Properties:
1. Flush Bolts:
a. Pairs of Swing Doors: At inactive leaves, provide flush bolts of type as required to comply with code.
b. Manual Flush Bolts: Manually latching upon closing of door leaf.
1) Bolt Throw: 3/4 inch, minimum.
2. Dustproof Strikes: For bolting into floor, provide except at metal thresholds.

C. Options:
1. Extension Bolts: In leading edge of door, one bolt into floor, one bolt into top of frame.
2. Lever extensions: Provide for top bolt at oversized doors.

D. Products:
1. Manual flush bolts. 3900 Series

2.05 EXIT DEVICES

A. Manufacturers:
1. BEST, dormakaba Group: www.bestaccess.com/#sle.
2. dormakaba.
3. Sargent.

B. Properties:
1. Actuation: Push Pad.
2. Chassis:
a. Construction: Investment cast steel, zinc dichromate plated.
b. Compatibility: Standard Stile and Narrow Stile doors.
3. Touchpads: 'T" style metal touchpads and rail assemblies with matching chassis covers end caps.
4. Latch Bolts: Stainless steel deadlocking with 3/4 inch projection using latch bolt.
5. Lever Design: Match project standard lockset trims.
6. Cylinder: Include where cylinder dogging or locking trim is indicated.
7. Strike as recommended by manufacturer for application indicated.
8. Sound dampening on touch bar.
9. Dogging:
a. Non-Fire-Resistance-Rated Devices: Cylinder dogging.
b. Fire-Resistance-Rated Devices: Manual dogging not permitted.
10. Touch bar assembly on wide style exit devices to have a 1/4 inch clearance to allow for vision frames.
11. All exposed exit device components to be of architectural metals and “true” architectural finishes.
12. Handing: Field-reversible.
13. Fasteners on Back Side of Device Channel: Concealed - exposed fasteners not allowed.
14. Vertical Latch Assemblies' Operation: Gravity, without use of springs.
a. Latch Bolts: Stainless steel, with 1/2 inch throw.

C. Grades: Complying with BHMA A156.3, Grade 1.
1. Provide exit devices tested and certified by UL or by a recognized independent laboratory for mechanical operational testing to 10 million cycles minimum with inspection confirming Grade 1 Loaded Forces have been maintained.

D. Standards Compliance:
1. UL Listed for Panic and Fire for Class II Circuitry.
2. Provide UL (DIR) listed exit device assemblies for fire-resistance-rated doors.
3. Comply with UL 10C.

E. Options:
1. Furnish less bottom rod (LBR) at scheduled locations to eliminate use of floor mounted strikes.

F. Products:
1. 2000.

2.06 ELECTRIC STRIKES

A. Manufacturers:
1. RCI; dormakaba Group: www.dormakaba.com/us-en/#sle.
2. HES.
3. Folger Adam.

B. Properties:
1. Provide UL (DIR) listed burglary-resistant devices.
2. Provide UL 1034 compliant devices.
3. Provide UL 10C compliant devices.
4. Non-handed devices suitable for door frame material and scheduled lock configuration.
5. Include transformer and rectifier as necessary for complete installation.
6. Accommodating latch projections of 1/2 inch or 3/4 inch.

C. Grades: Complying with BHMA A156.31, Grade 1.

D. Options: As applicable to each item specified.
1. Voltage: 24 VDC.
2. Latch bolt monitor.

E. Installation: Connect electric strikes into fire alarm where non-rated doors are scheduled to release with fire or sprinkler alarm condition.

F. Products:
1. 2 Series (F2164, 2366).

2.07 LOCK CYLINDER HOUSINGS AND CORES

A. Manufacturers:
1. dormakaba.
2. Schlage.
3. Sargent.
4. Best.

B. Properties:
1. Lock Cylinders:
a. Provide cams and/or tailpieces as required for locking devices.
b. Provide cylinders with appropriate format interchangeable cores as indicated in hardware sets.

C. Grades:
1. Standard Security Cylinders: Comply with BHMA A156.5.

D. Material:
1. Manufacturer's standard corrosion-resistant brass alloy.

E. Types: As applicable to each item specified.
1. Conventional Cores for existing key system provided by Owner.
2. Provide alternate proposal for rim cylinders, mortise cylinders, and cores, as indicated in Hardware Sets.

F. Products:
1. Rim and mortise cylinder housings (less core). 80 / 90 Series.

2.08 MORTISE LOCKS

A. Manufacturers:

1. BEST, dormakaba Group: www.bestaccess.com/#sle. (BASIS OF DESIGN)
2. Schlage.
3. Sargent.

B. Properties:
1. Mechanical Locks: Manufacturer's standard.
a. Fitting modified ANSI A115.1 door preparation.
b. Door Thickness Coordination Fitting 1-3/4 inch to 2-1/4 inch thick doors.
c. Latch: Solid, one-piece, anti-friction, self-lubricating stainless steel.
1) Latchbolt Throw: 3/4 inch, minimum.
d. Auxiliary Deadlatch: One piece stainless steel, permanently lubricated.
e. Deadbolt: Hardened stainless steel.
1) Deadbolt Throw: 1 inch, minimum.
f. Backset: 2-3/4 inch.
g. Lever Trim:
1) Functionality: Allow the lever handle to move up to 45 degrees from horizontal position prior to engaging the latchbolt assembly.
2) Strength: Locksets outside locked lever designed to withstand minimum 1,400 inch-lbs. of torque. In excess of that, a replaceable part will shear. Key from outside and/or inside lever will still operate lockset.
3) Spindle: Designed to prevent forced entry from attacking of lever.
4) Independent spring mechanism for each lever.
(a) Trim to be self-aligning and thru-bolted.
5) Handles: Made of forged or cast brass, bronze, or stainless steel construction. Levers that contain a hollow cavity are not acceptable.
6) Levers to operate a roller bearing spindle hub mechanism.

C. Finishes: See Door Hardware Schedule.
1. Core Faces: Match finish of lockset.

D. Grades:
1. Comply with BHMA A156.13, Grade 1, Security; Grade 2.

E. Products: Mortise locks.
1. 40H.

2.09 DOOR PULLS AND PUSH PLATES

A. Manufacturers:
1. Trimco: www.trimcohardware.com/#sle.
2. Burns.
3. Rockwood.

B. Properties:
1. Pull Type: Straight, unless otherwise indicated.
2. Push Plate Type: Flat, with square corners, unless otherwise indicated.
a. Edges: Beveled, unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: Stainless steel, unless otherwise indicated.

E. Products:
1. Push-Pull Plates. 1001 / 1017

2.10 CLOSERS

A. Manufacturers:
1. Best.
2. LCN.
3. Norton.

B. Properties:
1. Surface Mounted Closers: Manufacturer's standard.
a. Construction: Cast Iron.
b. Maximum Projection from Face of Door: 2-7/16 inches.
c. Mechanism: Separate tamper-resistant adjusting valves for closing and latching speeds.
d. Hydraulic Fluid: All-weather type.
e. Arm Assembly: Standard for product specified.
1) Include hold-open, integral stop, or spring-loaded stop feature, as specified in Door Hardware Schedule.
2) Parallel arm to be a heavy-duty rigid arm.
3) Where “IS” or “S-IS” arms are specified in hardware sets, if manufacturer does not offer this arm provide a regular arm mount closer in conjunction with a heavy-duty overhead stop equal to a dormakaba 900 Series.
f. Covers:
1) Type: Standard for product selected.
2) Material: Plastic.
3) Finish: Painted.

C. Grades:
1. Closers: Comply with BHMA A156.4, Grade 1.
a. Underwriters Laboratories Compliance:
1) Product Listing: UL (DIR) and ULC for use on fire-resistance-rated doors.
(a) UL 228 - Door Closers-Holders, With or Without Integral Smoke Detectors.
b. Testing Standards Compliance: Meeting requirements of UL 10C for positive pressure.

D. Types:
1. Rack-and-pinion, surface-mounted. 1-1/2 inches minimum bore.

E. Options:
1. Delayed action, adjustable with an independent valve.
2. Advanced backcheck.
3. Adjustable, for force or angle of opening hold open.

F. Installation:
1. Mounting: Includes surface mounted installations.
2. Mount closers on non-public side of door and stair side of stair doors unless otherwise noted in hardware sets.
3. At out swinging exterior doors, mount closer on interior side of door.
4. Provide adapter plates, shim spacers, and blade stop spacers as required by frame and door conditions.
5. Where an overlapping astragal is included on pairs of swinging doors, provide coordinator to ensure door leaves close in proper order.

G. Products:
1. Surface Mounted:
a. EHD9000

2.11 PROTECTION PLATES

A. Manufacturers:
1. Trimco: www.trimcohardware.com/#sle.
2. Burns.
3. Rockwood.

B. Properties:
1. Plates:

a. Kick Plates: Provide along bottom edge of each door, where indicated in hardware sets.
   1) Size: 8 inches high by 2 inches less than door width (LDW) on push side of door; 1 inch LDW on pairs of doors with no mullion.
b. Mop Plates: Provide along bottom edge of pull side of doors, where indicated in hardware sets.
   1) Size: 4 inches high by 1 inch less than door width (LDW) on pull side of door.
c. Edges: Beveled, on four (4) unless otherwise indicated.

C. Grades: Comply with BHMA A156.6.

D. Material: As indicated for each item by BHMA material and finish designation.
   1. Metal Properties: Stainless steel.
      a. Metal, Standard Duty: Thickness 0.050 inch, minimum.

E. Installation:
   1. Fasteners: Countersunk screw fasteners

F. Products:
   1. K0050, KM050.

2.12 STOPS AND HOLDERS

A. Manufacturers:
   1. Trimco: www.trimcohardware.com/#sle.
   2. Burns.
   3. Rockwood.

B. General: Provide overhead stop/holder when wall or floor stop is not feasible.

C. Grades:
   1. Wall Bumpers and Floor Stops: Comply with BHMA A156.16 and Resilient Material Retention Test as described in this standard.

D. Material: Base metal as indicated for each item by BHMA material and finish designation.

E. Types:
   1. Wall Bumpers: Bumper, concave, wall stop.
   2. Floor Stops: Provide with dome floor stop.

F. Installation:
   1. Non-Masonry Walls: Confirm adequate wall reinforcement has been installed to allow lasting installation of wall bumpers.

G. Products:
   1. Wall Bumpers. 1270WV.
   2. Floor Stops. 1211.

2.13 WEATHERSTRIPPING AND GASKETING

A. Manufacturers:
   1. National Guard Products, Inc: www.ngpinc.com/#sle.
   2. Reese.
   3. Pemko.

B. Properties:
   1. Weatherstripping Air Leakage Performance: Not exceeding 0.3 cfm/sq ft of door opening at 0.3 inches of water pressure differential for single doors, and 0.5 cfm/sq ft of door area at 0.3 inches of water pressure differential for double doors for gasketing other than smoke control, as tested according to ASTM E283/E283M; with resilient or flexible seal strips that are easily replaceable and readily available from stocks maintained by manufacturer.
   2. Adhesive-Backed Perimeter Gasketing: Silicone gasket material applied to frame with self- adhesive.

3. Automatic Door Bottoms: Sponge neoprene gasket material held in place by Aluminum housing that automatically drops to form seal when door is closed.
    a. Mounting: Surface mounted with screws on bottom edge of door or mortised into bottom of door as required for model of automatic door bottom in hardware set.

C. Grades: Comply with BHMA A156.22.

D. Products:
1. Weatherstripping: See Door Hardware Schedule.
2. Smoke Seals: See Door Hardware Schedule.
3. Door Bottom Seals:
    a. Door Bottoms: See Door Hardware Schedule.
    b. Automatic Door Bottoms: See Door Hardware Schedule.

2.14 MISCELLANEOUS ITEMS

A. Manufacturers:
1. BEST, dormakaba Group: www.bestaccess.com/#sle.
2. Trimco: www.trimcohardware.com/#sle.
3. Rockwood.

B. Properties:
1. Coat Hooks: Provide on room side of door, screw fastened.
    a. Material: Brass.
2. Silencers: Provide at equal locations on door frame to mute sound of door's impact upon closing.
    a. Single Door: Provide three on strike jamb of frame.
    b. Pair of Doors: Provide two on head of frame, one for each door at latch side.
    c. Material: Rubber, gray color.

C. Products:
1. Coat Hooks.
    a. 3072.
2. Silencers.
    a. 1229A.

2.15 ELECTRIFIED HARDWARE

A. Manufacturers:
1. dormakaba; dormakaba Group: www.dormakaba.com/us-en/#sle.
2. RCI; dormakaba Group: www.dormakaba.com/us-en/#sle.
3. Sargent.

B. Properties:
1. Door Position Switches: Recessed devices with balanced magnetic contacts.
    a. Power Requirement: 50mA Max, 100 VDC.
    b. SPDT configuration with magnetic tamper.
2. Power Supply Units: Manufacturer's standard.
    a. Regulatory Compliance:
        1) United States Compliance:
            (a) UL listed for Class II Output.
            (b) Comply with UL 294 Standards incorporating enhanced Access Control. communications capabilities.
    b. Enclosures: NEMA Type 1, with hinged cover and knockouts.
    c. Power: 12/24 VDC filtered regulated output; 2 amps.
        1) Incoming Power Voltage: 120 VAC.
    d. Emergency Release Terminals: Designed to release devices upon activation of fire alarm system.
    e. Auxiliary contacts for remote signaling.

f. User-selectable time delay from 0 to 4 minutes.
g. Fire Alarm System Interface: Standard.
h. Output Distribution Board with indicator LEDs.
i. Battery backup.
j. On/Off LED power indicator.

C. Products:
1. Door Position Switches:
a. MC4.
2. Power Supplies:
a. DKPS Series.

2.16 KEYS AND CORES

A. Manufacturers:
1. Permanent conventional cores and associated master keys and operating keys to match existing key system provided by Owner.

2.17 KEY CABINETS

A. Manufacturers:
1. Lund Equipment Company, Inc: www.lundkey.com/#sle.
2. Telkee: www.telkee.com/#sle.

B. Properties:
1. Key Management System: For each keyed lock on project, provide one set of consecutively numbered duplicate key tags with hanging hole and snap catch.
2. Security Key Tags: For each keyed lock on project, provide one set of matching key tags for permanent attachment to one key of each set.
3. Provide key collection envelopes, receipt cards, and index cards in quantity suitable to manage number of keys.
4. Mounting: Wall surface mounted.
5. Capacity: Actual quantity of keys, plus 25 percent additional capacity.
6. Key cabinet lock to facility's keying system.

C. Finishes: Baked enamel, manufacturer's standard color.

D. Material: Sheet steel.

E. Products:
1. Lund
2. Telkee

2.18 FINISHES

A. Finishes: Identified in Hardware Sets.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that doors and frames are ready to receive this work; labeled, fire-rated doors and frames are properly installed, and dimensions are as indicated on shop drawings.

B. Correct all defects prior to proceeding with installation.

C. Verify that electric power is available to power operated devices and of correct characteristics.

3.02 INSTALLATION

A. Install hardware in accordance with manufacturer's instructions and applicable codes.

B. Install hardware using the manufacturer’s fasteners provided. Drill and tap all screw holes located in metallic materials. Do not use “Riv-Nuts” or similar products.

C. Install hardware on fire-rated doors and frames in accordance with applicable codes and NFPA 80.

D. Install hardware for smoke and draft control doors in accordance with NFPA 105.

E. Use templates provided by hardware item manufacturer.

F. Do not install surface mounted items until application of finishes to substrate are fully completed.

G. Wash down masonry walls and complete painting or staining of doors and frames.

H. Complete finish flooring prior to installation of thresholds.

I. Door Hardware Mounting Heights: Distance from finished floor to center line of hardware item. As indicated in following list, unless noted otherwise in Door Hardware Schedule or on drawings.
   1. For Steel Doors and Frames: Install in compliance with DHI (LOCS) recommendations.
   2. For Steel Door Frames: See Section 08 12 13.
   3. For Aluminum-Framed Storefront Doors and Frames: See Section 08 43 13.
   4. For Wood Doors: Install in compliance with DHI WDHS.3 recommendations.
   5. Flush Wood Doors: See Section 08 14 16.
   6. Mounting heights in compliance with ADA Standards:
      a. Locksets: 40-5/16 inch.
      b. Push Plates/Pull Bars: 42 inch.
      c. Exit Devices: 39-5/16 inch.

J. Include in installation for existing doors and frames any necessary field modification and field preparation of doors and frames for new hardware. Provide necessary fillers, reinforcements, and fasteners for mounting new hardware and to cover existing door and frame preparations.

3.03 FIELD QUALITY CONTROL

A. Perform field inspection and testing under provisions of Section 01 40 00 - Quality Requirements.

3.04 ADJUSTING

A. Adjust work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Adjust hardware for smooth operation.

C. Adjust gasketing for complete, continuous seal; replace if unable to make complete seal.

3.05 CLEANING

A. Clean finished hardware in accordance with manufacturer's written instructions after final adjustments have been made.

B. Clean adjacent surfaces soiled by hardware installation activities.

C. Replace items that cannot be cleaned to manufacturer's level of finish quality at no additional cost.

D. See Section 01 74 19 - Construction Waste Management and Disposal, for additional requirements.

3.06 PROTECTION

A. Protect finished Work under provisions of Section 01 70 00 - Execution and Closeout Requirements.

B. Do not permit adjacent work to damage hardware or finish.

3.07 HARDWARE SETS

Manufacturer List

Code:	Name:
BES	BEST
PRE	BEST (Precision)
DKA	dormakaba Architectural
NGP	National Guard Products
RCI	Rutherford Controls Inc.
TRI	Trimco Hardware

Option List

Code:	Name:
BSHD90	Heavy-Duty Blade Stop Spacer
LD	Less Dogging
LBR	Less bottom rod
B4E	Beveled 4 edges
FL	Fire Rated Hardware
VIB	Double Visual Indicator
LDW	Less than Door Width
CD	Cylinder Dogging: 1-1/4" Mortise Cylinder not included
NRP	Non-Removable Pins
F2LM	Plug in Latch Monitor
CSK	Counter Sunk Holes

Finish list

Code:	Name:
26D	Satin Chromium plated
32D	Satin Stainless Steel
626	Satin Chromium plated
630	Satin Stainless Steel
689	Aluminum Painted
US27	Mill Aluminum
A	Anodized Aluminum
B	Brown
C	Charcoal

HARDWARE SETS

Set #1 - INT.ALUM. / CARD READER

Doors: 332A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA

1	Conv. Core	Provided by Owner		
1	Electric Strike	2364 F2LM	32D	RCI
1	Door Closer	EHD90 16 AF90	689	BES
1	Wall Stop	1270 CV		TRI
1	Gasketing	Provided by Alum. Door Manufacturer		
1	Door Position Switch	MC4		DKA
1	Power Supply	DKPS-2A		RCI
1	PIR Req. to Exit Switch	Provided by Access Control Contractor		
1	Card Reader	Provided by Access Control Contractor		

NOTE: Door normally closed and locked. Turning key in outside cylinder retracts latch bolt, allowing entry. Presenting valid credential to card reader temporarily releases electric strike, allowing door to be pushed open. Door Position Switch monitors door status. Latch monitor switch in electric strike monitors latch engagement with strike. PIR Request-to-Exit Switch is activated upon approach to door when exiting, shunting forced door alarm at Access Control System. Electric Strike is fail safe and automatically unlocks during fire alarm or loss of power. Free egress is possible at all times. Coordinate wiring and electrical requirements with Electrical Contractor and Access Control Contractor.

Set #2 - INT.WD. / CARD READER

Doors: 590A, 618A, 671A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Electric Strike	F2164 F2LM	32D	RCI
1	Door Closer	EHD90 16 AF90	689	DKA
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP
1	Door Position Switch	MC4		DKA
1	Power Supply	DKPS-2A		RCI
1	PIR Req. to Exit Switch	Provided by Access Control Contractor		
1	Card Reader	Provided by Access Control Contractor		

NOTE: Door normally closed and locked. Turning key in outside cylinder retracts latch bolt, allowing entry. Presenting valid credential to card reader temporarily releases electric strike, allowing door to be pushed open. Door Position Switch monitors door status. PIR Request-to-Exit Switch is activated upon approach to door when exiting, shunting forced door alarm at Access Control System. Electric Strike is fail secure and remains locked during fire alarm or loss of power. Free egress is possible at all times. Coordinate wiring and electrical requirements with Electrical Contractor and Access Control Contractor.

Set #3 - INT.WD. / CARD READER

Doors: 631A, 671B

3	Hinge	FBB168 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Electric Strike	F2164 F2LM	32D	RCI
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP
1	Wall Stop	1270 CV		TRI
1	Door Position Switch	MC4		DKA
1	Power Supply	DKPS-2A		RCI
1	PIR Req. to Exit Switch	Provided by Access Control Contractor		
1	Card Reader	Provided by Access Control Contractor		

NOTE: Door normally closed and locked. Turning key in outside cylinder retracts latch bolt, allowing entry. Presenting valid credential to card reader temporarily releases electric strike, allowing door to be pushed open. Door Position Switch monitors door status. PIR Request-to-Exit Switch is activated upon approach to door when exiting, shunting forced door alarm at Access Control System. Electric Strike is fail secure and remains locked during fire alarm or loss of power. Free egress is possible at all times. Coordinate wiring and electrical requirements with Electrical Contractor and Access Control Contractor.

Set #4 - INT.WD. / FAIL SAFE ELEC. STRIKE

Doors: 248B

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Electric Strike	2364 F2LM	32D	RCI
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP
1	Power Supply	DKPS-2A		RCI

NOTE: Door normally closed and locked. Turning key in outside cylinder retracts latch bolt, allowing entry. Latch monitor switch in electric strike monitors latch engagement with strike. Electric Strike is fail safe and automatically unlocks during fire alarm or loss of power. Free egress is possible at all times.

Coordinate wiring and electrical requirements with Electrical Contractor and Fire Alarm System Contractor.

Set #5 -

Doors: 541B

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #6 -

Doors: 541A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 IS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP

Set #7 -

Doors: 424A

3	Hinge	FBB179 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP
1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP

Set #8 -

Doors: 446E

6	Hinge	FBB168 NRP 45X45	26D	BES
2	Exit Device	FL 2208 LBR 4908 C	630	PRE
2	Rim Cylinder	80R 20	626	DKA
2	Conv. Core	Provided by Owner		
2	Door Closer	EHD90 16 DS90	689	BES
2	Kick Plate	K0050 8" X 1" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050 Head & Jambs (2)	B	NGP
1	Gasketing	5070	B	NGP

Set #9 -

Doors: 459A, 466A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP
1	Wall Stop	1270 CV		TRI

Set #10 -

Doors: 563A, 571A, 632A, 640A, 654A

6	Hinge	FBB168 NRP 45X45	26D	BES
2	Exit Device	2208 LD LBR 4908 C	630	PRE
2	Rim Cylinder	80R	626	DKA
2	Conv. Core	Provided by Owner		
2	Door Closer	EHD90 16 DS90	689	BES
2	Kick Plate	K0050 8" X 1" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050 Head & Jambs (2)	B	NGP
1	Gasketing	5070	B	NGP

Set #11 -

Doors: 563B, 563D, 571B, 632D, 640B

3	Hinge	FBB168 NRP 45X45	26D	BES

1	Exit Device	2103 LD 4903 C	630	PRE
1	Rim Cylinder	80R	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050 Head & Jambs (2)	B	NGP
1	Wall Stop	1270 CV		TRI

Set #12 -

Doors: 571D, 632B, 640D, 654B

3	Hinge	FBB168 NRP 45X45	26D	BES
1	Exit Device	2103 LD 4903 C	630	PRE
1	Rim Cylinder	80R	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050 Head & Jambs (2)	B	NGP

Set #13 -

Doors: 239A

6	Hinge	FBB168 45X45	26D	BES
2	Flush Bolt	3913	630	TRI
1	Strike	3910	630	TRI
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
2	Door Closer	EHD90 16 IS90	689	BES
2	Kick Plate	K0050 8" X 1" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP
1	Astragal	139SP	A	NGP

NOTE: Astragal to be mounted on push side of inactive leaf.

Set #14 -

Doors: 257A

6	Hinge	FBB168 45X45	26D	BES
2	Flush Bolt	3913	630	TRI
1	Strike	3910	630	TRI
1	Mortise Lock	45H 0 AT 3 H	626	BES

1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
2	Door Closer	EHD90 16 IS90	689	BES
2	Kick Plate	K0050 8" X 1" LDW CSK B4E Heavy	630	TRI
2	Silencer	1229A	Gray	TRI
1	Astragal	139SP	A	NGP

NOTE: Astragal to be mounted on push side of inactive leaf.

Set #15 -

Doors: 212A

6	Hinge	FBB168 45X45	26D	BES
2	Flush Bolt	3913	630	TRI
1	Strike	3910	630	TRI
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
2	Door Closer	EHD90 16 AF90	689	BES
2	Kick Plate	K0050 8" X 1" LDW CSK B4E Heavy	630	TRI
2	Wall Stop	1270 CV		TRI
2	Silencer	1229A	Gray	TRI
1	Astragal	139SP	A	NGP

NOTE: Astragal to be mounted on push side of inactive leaf.

Set #16 -

Doors: 260A, 261A

6	Hinge	FBB168 NRP 45X45	26D	BES
2	Flush Bolt	3913	630	TRI
1	Strike	3910	630	TRI
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Door Closer	EHD90 16 AF90P	689	BES
2	Kick Plate	K0050 8" X 1" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
2	Silencer	1229A	Gray	TRI

Set #17 -

Doors: 151A, 645A

3	Hinge	FBB168 NRP 45X45	26D	BES
1	Exit Device	2103 CD 4903 C	630	PRE
1	Rim Cylinder	80R	626	DKA
1	Mortise Cylinder	90 19 A	626	DKA
2	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
3	Silencer	1229A	Gray	TRI

Set #18 -

Doors: 519A, 520A, 316A, 347A, 412B

3	Hinge	FBB168 NRP 45X45	26D	BES
1	Exit Device	2108 CD 4908 C	630	PRE
1	Rim Cylinder	80R	626	DKA
1	Mortise Cylinder	90 19 A	626	DKA
2	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
3	Silencer	1229A	Gray	TRI

Set #19 - INT.ALUM.

Doors: 392A, 393A

3	Hinge	FBB179 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Door Closer	EHD9AC BSHD90	689	BES
1	Gasketing	2525 Head & Jambs (2)	C	NGP
1	Automatic Door Bottom	220N 36"	A	NGP

Set #20 - INT.ALUM.

Doors: 510A, 510B

4	Hinge	FBB168 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90P	689	BES
1	Wall Stop	1270 CV		TRI
1	Gasketing	Provided by Alum. Door Manufacturer		

Set #21 - INT.ALUM.

Doors: 537A, 554A

3	Hinge	FBB168 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Door Closer	EHD9AC BSHD90	689	BES
1	Gasketing	Provided by Alum. Door Manufacturer		

Set #22 - INT.ALUM.

Doors: 555A, 647A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Door Closer	EHD90 16 IS90	689	BES
1	Conv. Core	Provided by Owner		
1	Gasketing	Provided by Alum. Door Manufacturer		

Set #23 -

Doors: 653A, 482A, 494A, 328A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		

1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #24 -

Doors: 563C, 571C, 632C, 640C, 654C

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #25 -

Doors: 654D

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 IS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP

Set #26 -

Doors: 146A, 573A, 573B, 579A, 580A, 580B, 620A, 620B, 628A, 628B

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP

Set #27 -

Doors: 668A, 668B

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 IS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP
1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP

Set #28 -

Doors: 563E, 563F, 571E, 571F, 632E, 632F, 640E, 640F, 654E, 654F

3	Hinge	FBB168 45X45	26D	BES
1	Exit Device	2114 4914 C	630	PRE
1	Door Closer	EHD90 16 PHP90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #29 -

Doors: 646A

3	Hinge	FBB191 45X45	32D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
3	Silencer	1229A	Gray	TRI
1	Wall Stop	1270 CV		TRI

Set #30 -

Doors: 323A

3	Hinge	FBB191 NRP 45X45	32D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
3	Silencer	1229A	Gray	TRI

Set #31 -

Doors: 203B, 234A, 511A, 591A, 611A

3	Hinge	FBB179 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
3	Silencer	1229A	Gray	TRI

Set #32 -

Doors: 162A, 159A, 179A, 213B, 234B, 251A, 540A, 550A, 575A, 576A, 587A, 624A, 625A, 655A, 656A, 663A, 308A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
3	Silencer	1229A	Gray	TRI

Set #33 -

Doors: 173A, 248A, 513A, 514A, 518A, 553A, 562A, 583A, 643A, 652A, 658A, 660A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA

1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
3	Silencer	1229A	Gray	TRI

Set #34 -

Doors: 138A, 204A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 IS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
3	Silencer	1229A	Gray	TRI

Set #35 -

Doors: 154A, 158A, 161A, 172A, 183B, 218B, 219A, 250A, 252A, 253A, 256A, 258A, 259A, 515A, 517A, 521A, 522A, 524A, 525A, 526A, 527A, 528A, 529A, 530A, 531A, 532A, 533A, 534A, 535A, 536A, 539A, 542A, 543A, 544A, 545A, 549A, 551A, 552A, 572A, 578A, 582A, 594A, 595A, 596A, 597A, 605A, 606A, 607A, 608A, 612A, 613A, 614A, 619A, 622A, 623A, 627A, 630A, 641A, 642A, 657A, 662A, 664A, 665A, 666A, 667A, 303A, 305A, 314A, 315A, 322A, 339A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Wall Stop	1270 CV		TRI
3	Silencer	1229A	Gray	TRI

Set #36 -

Doors: 516A, 556A, 557A, 558A, 559A, 561A, 588A, 592A, 592B, 598A, 598B, 603A, 603B, 609A, 609B, 648A, 649A, 650A, 651A, 659A, 321B

3	Hinge	FBB179 45X45	26D	BES

1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Wall Stop	1270CV OR 1211 as required.		TRI
1	Gasketing	5050	B	NGP
1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP

NOTE: Install floor stop where wall bumper is not suitable.

Set #37 -

Doors: 143A, 163A, 660B

3	Hinge	FBB179 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Conv. Core	Provided by Owner		
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP
1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP

Set #38 -

Doors: 178A, 178B, 601A, 601B

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
3	Silencer	1229A	Gray	TRI

Set #39 -

Doors: 523A, 324A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 R 3 H	626	BES

1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 JTH90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Wall Stop	1270 CV		TRI
1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP
1	Gasketing	5050 Head & Jambs (2)	B	NGP

Set #40 -

Doors: 340A

3	Hinge	FBB168 NRP 45X45	26D	BES
1	Mortise Lock	45H 0 D 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 DS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
3	Silencer	1229A	Gray	TRI

Set #41 -

Doors: 424B

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 AT 3 H	626	BES
1	Mortise Cylinder	90 19 A	626	DKA
1	Conv. Core	Provided by Owner		
1	Door Closer	EHD90 16 IS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Gasketing	5050	B	NGP

Set #42 -

Doors: 176A, 177A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 N 3 H	626	BES
1	Dome Stop	1211	630	TRI
1	Gasketing	5050	B	NGP
1	Automatic Door Bottom	423N 36" x END CAPS	US27	NGP
1	Wall Stop	1270 CV		TRI

Set #43 -

Doors: 201A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 L 3 H VIB	626	BES
1	Door Closer	EHD90 16 IS90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #44 -

Doors: 185A, 574A, 581A, 621A, 629A, 661A, 669A, 670A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 L 3 H VIB	626	BES
1	Door Closer	EHD90 16 AF90	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #45 -

Doors: 593A, 599A, 604A, 610A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 L 3 H VIB	626	BES
1	Door Closer	EHD90 16 AF90	689	BES
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Wall Stop	1270 CV		TRI
1	Coat Hook	3072	630	TRI
1	Gasketing	5050	B	NGP

Set #46 -

Doors: 128A, 129A

3	Hinge	FBB168 45X45	26D	BES
1	Mortise Lock	45H 0 L 3 H VIB	626	BES
1	Door Closer	EHD90 16 DS90	689	BES

1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Gasketing	5050	B	NGP

Set #47 -

Doors: 547A, 548A, 584A, 586A, 615A, 617A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 L 3 H VIB	626	BES
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Wall Stop	1270 CV		TRI
1	Gasketing	5050	B	NGP

Set #48 -

Doors: 589A

3	Hinge	FBB179 45X45	26D	BES
1	Mortise Lock	45H 0 L 3 H VIB	626	BES
1	Door Closer	EHD90 16 AF90P	689	BES
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Wall Stop	1270 CV		TRI
1	Coat Hook	3072	630	TRI
1	Gasketing	5050	B	NGP

Set #49 -

Doors: 600A, 602A

3	Hinge	FBB168 45X45	26D	BES
1	Door Closer	EHD90 16 AF90	689	BES
1	Push Plate	1001 3	630	TRI
1	Pull Plate	1017 3C	630	TRI
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
1	Mop Plate	KM050 4" X 1" LDW CSK B4E	630	TRI
1	Wall Stop	1270 CV		TRI
2	Silencer	1229A	Gray	TRI

Set #50 -

Doors: 569A, 570A, 638A, 639A

3	Hinge	FBB168 45X45	26D	BES
1	Door Closer	EHD90 16 DS90	689	BES
1	Push Plate	1001 3	630	TRI
1	Pull Plate	1017 3C	630	TRI
1	Kick Plate	K0050 8" X 2" LDW CSK B4E Heavy	630	TRI
2	Silencer	1229A	Gray	TRI

Set #51 - EXISTING DOOR RELOCATED

Doors: 131A, 134A, 160A, 160B, 171D

1	N/A	N/A

NOTE: Existing door and hardware relocated.

Set #52 - SECURITY DOOR

Doors: 565A, 566A, 566B, 567A, 567B, 568A, 634A, 635A, 635B, 636A, 636B, 637A, 425A, 426A, 428A, 429A

1	N/A	N/A

NOTE: Hardware provided under Section 08 71 63.

ALTERNATE 1:

Provide an alternate proposal to provide Best 12E and 1E Series rim and mortise cylinders, complete with Best CORMAX, 7-pin, Small Format Interchangeable Cores (SFIC) for all locksets, exit devices, and mullions for entire facility. Alternate will include all required cylinders for this current scope of work in lieu of the cylinders specified in hardware sets above. A site survey of the facility will be required to determine specific requirements and cylinder quantities. Coordinate site survey with Architect.

OPENING LIST:

OPENING:	SET:	RATING:
128A	46	
129A	46	
131A	51	
134A	51	
138A	34	
143A	37	
146A	26	
151A	17	
154A	35	
158A	35	
159A	32	
160A	51	
160B	51	
161A	35	
162A	32	
163A	37	
171D	51	
172A	35	
173A	33	
176A	42	
177A	42	
178A	38	
178B	38	
179A	32	

183B	35	
185A	44	
201A	43	
203B	31	
204A	34	
212A	15	
213B	32	
218B	35	
219A	35	
234A	31	
234B	32	
239A	13	
248A	33	
248B	4	
250A	35	
251A	32	
252A	35	
253A	35	
256A	35	
257A	14	
258A	35	
259A	35	
260A	16	
261A	16	
303A	35	
305A	35	
308A	32	
314A	35	
315A	35	
316A	18	
321B	36	
322A	35	
323A	30	
324A	39	
328A	23	S
332A	1	
339A	35	
340A	40	
347A	18	
392A	19	
393A	19	
412B	18	
424A	7	60
424B	41	
425A	52	
426A	52	
428A	52	
429A	52	

446E	8	
459A	9	
466A	9	60
482A	23	S
494A	23	S
510A	20	
510B	20	
511A	31	
513A	33	
514A	33	
515A	35	
516A	36	
517A	35	
518A	33	
519A	18	
520A	18	
521A	35	
522A	35	
523A	39	
524A	35	
525A	35	
526A	35	
527A	35	
528A	35	
529A	35	
530A	35	
531A	35	
532A	35	
533A	35	
534A	35	
535A	35	
536A	35	
537A	21	
539A	35	
540A	32	
541A	6	45
541B	5	45
542A	35	
543A	35	
544A	35	
545A	35	
547A	47	
548A	47	
549A	35	
550A	32	
551A	35	
552A	35	
553A	33	

554A	21	
555A	22	
556A	36	
557A	36	
558A	36	
559A	36	
561A	36	
562A	33	
563A	10	S
563B	11	S
563C	24	S
563D	11	S
563E	28	
563F	28	
565A	52	
566A	52	
566B	52	
567A	52	
567B	52	
568A	52	
569A	50	
570A	50	
571A	10	S
571B	11	S
571C	24	S
571D	12	S
571E	28	
571F	28	
572A	35	
573A	26	
573B	26	
574A	44	
575A	32	
576A	32	
578A	35	
579A	26	
580A	26	
580B	26	S
581A	44	
582A	35	
583A	33	
584A	47	
586A	47	
587A	32	
588A	36	
589A	48	
590A	2	
591A	31	

592A	36	
592B	36	
593A	45	
594A	35	
595A	35	
596A	35	
597A	35	
598A	36	
598B	36	
599A	45	
600A	49	
601A	38	
601B	38	
602A	49	
603A	36	
603B	36	
604A	45	
605A	35	
606A	35	
607A	35	
608A	35	
609A	36	
609B	36	
610A	45	
611A	31	
612A	35	
613A	35	
614A	35	
615A	47	
617A	47	
618A	2	
619A	35	
620A	26	
620B	26	S
621A	44	
622A	35	
623A	35	
624A	32	
625A	32	
627A	35	
628A	26	
628B	26	S
629A	44	
630A	35	
631A	3	
632A	10	S
632B	12	S
632C	24	S

632D	11	S
632E	28	
632F	28	
634A	52	
635A	52	
635B	52	
636A	52	
636B	52	
637A	52	
638A	50	
639A	50	
640A	10	S
640B	11	S
640C	24	S
640D	12	S
640E	28	
640F	28	
641A	35	
642A	35	
643A	33	
645A	17	
646A	29	
647A	22	
648A	36	
649A	36	
650A	36	
651A	36	
652A	33	
653A	23	S
654A	10	S
654B	12	S
654C	24	S
654D	25	S
654E	28	
654F	28	
655A	32	
656A	32	
657A	35	
658A	33	
659A	36	
660A	33	
660B	37	
661A	44	
662A	35	
663A	32	
664A	35	
665A	35	
666A	35	

667A	35	
668A	27	
668B	27	S
669A	44	
670A	44	
671A	2	
671B	3	

END OF SECTION 08 71 00

SECTION 087163 - SECURITY HARDWARE

PART 1 - GENERAL

1.01 RELATED DOCUMENTS

A. Drawings and general provisions of Contract, including General and Supplementary Conditions and Division 1 Specification sections, apply to work of this section.

B. Related Sections to include the following:
1. Section 270000 - Security
2. Section 083463 - Security Hollow Metal Doors and Frames

1.02 DESCRIPTION

A. The work required under this section consists of furnishing security hardware and the installation of security hardware and related items necessary to complete the work indicated on the drawings and described in this Specification.

B. Where builder type hardware is required in a security hardware set, it shall be furnished here under as listed for the specific case.

C. All locksets shall be by the same manufacturer.

D. Doors listed in the "Door Schedule" shall meet U.L. requirements. Otherwise, Architect/Engineer shall be notified why they cannot be rated at least 10 days prior to bid date.

1.03 APPLICABLE PUBLICATIONS

A. All work shall be done in accordance with the following publications:
1. The National Association of Architectural Metal Manufacturers (ANSI/NAAMM).
2. American National Standard Institute.
3. Door and Hardware Institute, "Recommended Location for Builders' Hardware for Custom Steel Doors and Frames."
4. Door and Hardware Institute, 8P, "Hardware for Labeled Fire Doors."
5. ANSI A156.1, "Butts and Hinges."
6. ANSI A156.4 - "Door Controls - Closers."
7. ANSI A156.5 - "Auxiliary Locks and Associated Products."
8. ANSI A156.6 - "Architectural Door Trim."
9. ANSI A156.7 - "Template Hinge Dimension."
10. ANSI A156.13 - "Mortise Locks & Latches."
11. ANSI A156.15 - "Closer Holder Release Devices."
12. ANSI A156.16 - "Auxiliary Hardware."
13. N.F.P.A. 80

1.04 APPROVED MANUFACTURERS

A. For the electrical or mechanical security locks, individual control devices, miscellaneous security hardware are as follows:

1. Southern Folger
2. Brink Locks

1.05 SUBMITTALS

A. The Contractor shall furnish the operating and specifications manuals for all security type hardware. Bind manuals in loose-leaf binders. Each manual shall bear name, address, and telephone number of manufacturer's representative in the area of project.

B. The Contractor shall, upon notice of the Architect and without additional cost to Owner, provide a factory representative specially trained in operation of security equipment and with a thorough knowledge of its mechanism, for an eight-hour workday instruction and training period. Factory representative must be capable of training custodial personnel in operation, repair and upkeep. The training program shall be recorded and turned over to the Owner.

C. A representative of the manufacturer shall be at the site on a full time basis during the period when the locks are being installed to provide the supervising of the installation.

D. Shop drawings shall be submitted electronically in PDF format. And shall have a label on the front cover with job name, date, Contractor's name, and specification number/title. Shall contain the entire shop drawing with no sheets longer than 11" x 17". Shop drawings submittal shall contain catalogue cut sheets, templates and specification on hardware sets, closers, pushbuttons, door position switches, hinges, strikes, pulls, thresholds, weatherstripping, silencers, door bumpers, electric bolt keeps, security screws, and wiring diagrams. They shall be separated by a tabbed, reinforced index sheet indicating what is behind each section. Door references shall be the same as used in the contract documents. When assembling the shop drawings, if there are questions, item in question should be highlighted in yellow. Wiring diagrams are not valid until the Architect/Engineer has reviewed them. The wiring diagrams are not for the Architect/Engineer; they are for the Electronic Security Contractor, (ESC).

E. The Security Hardware Contractor shall furnish one (1) of each type of electric lock, except for sliding doors, to the ESC after security hardware has been approved by the Architect/Engineer. Thirty (30) days after the ESC has received the locks, there shall be a formal on site meeting which shall include the Security Hardware Contractor, the Masonry Contractor, the Electronics and Communications Design Engineer, and the Architect to discuss the upcoming work and the coordination of that work and shop drawings.
   1. The following items shall be discussed:
      a. Mounting of locks and frames, which shall include masonry items.
      b. Routing of conduit.
      c. Preparation of doors and frames (opening for locks and DS).
      d. Wiring diagrams.
      e. Frames and glazing.

1.06 PRODUCTS

A. The Contractor shall secure from the hardware manufacturer the necessary template for use by the hollow metal manufacturer and shall promptly furnish these templates to the manufacturers to eliminate possibility of delay.

B. Each item of security hardware shall be packed and marked in accordance with the set numbers

on approved hardware schedule. Shipping cartons shall be marked "security hardware" for identification on the job.

C. The hardware operating characteristics shall be configured to be fully compatible with the operational requirements contained in the locking control system specifications.

1.07 KEYING

A. Establish separate master key systems for this project: one (1) system shall be for the security Paracentric type hardware. Each master key system may consist of more than one master key. Key shall be in accordance with the Door and Hardware Institute manual, "Keying -Procedures, Systems and Nomenclature". Coordinate with the Owners existing
B. keying system.

B. Individual keying of all cylinder shall be only as directed by the Owner. It is required that a meeting be arranged with the Owner to lay out the required keying systems. A complete keying schedule shall be submitted for review and approval by the Architect and Owner after this meeting.

C. Furnish six (6) master keys for each individual master key set established. Unless indicated otherwise, six (6) keys for each key set will be provided.

D. The representative of the security hardware manufacturer or supplier who is designated to supervise the installation of locks shall be responsible for the day keys and shall set up the key control system specified below. All day keys shall be delivered to the Owner in the manner he directs. The Owner will provide a receipt for all keys received. No more than two (2) day keys for each lock shall be produced unless specifically directed otherwise.

E. All master keys shall be sent to the Owner prepaid via registered mail.

G. All locks shall be keyed two sides except for cell doors. Cell doors shall be keyed one side, outside only.

1.08 SPARE PARTS

A. Provide one (1) spare lock of each type and one (1) spare door position switch.

B. Provide 10 additional door silencers.

C. Provide 10 additional screws of each type. Bag and identify.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Hinges: 4-1/2" x 4-1/2" ball bearing construction with stainless steel non-removable pin and hospital tip, materials steel, standard template screw location, security type (Spanner) flat head screws. Non-removable pin shall be held in place with a concealed pin, not a set screw. Acceptable manufacturers: Southern Steel # 204SS or approved equal.

B. Mechanical Door Position Switch: The Mechanical door position switch shall be concealed in the head of the door frame. In any case, the door position switch shall be tamperproof. The switch shall be adjustable so that indication is shown when the door is ajar one half inch or more.
   1. Acceptable Manufacturers:
      a. Southern Steel 240CPS
      b. Brinks 201030
      c. ASSA 150

C. Mogul Cylinder: A special "Mogul" cylinder approximately twice the size diameter of a commercial Mortise lock cylinder with all internal parts proportionately larger. Special "Mogul" keys and restricted keying are required. The sale of cut keys and blanks shall be factory regulated to control usage and reproduction. The design shall be wear and pick resistant and shall include a minimum of five stainless steel 5/32" diameter pin tumblers, stainless steel springs, and stainless steel ball bearings which intermesh with the key and the pin tumblers to reduce wear on both. Acceptable manufacturers are Folger Adam and Southern Steel Co.

   1. Where builder hardware cylinders are used, the MEDECO seven tumbler cylinder shall be provided.
   2. ASSA mogul new cylinders.

D. Door Pull: ("D" Ring) outside of the holding cell door only
   1. Material: Manganese bronze, satin finish (approximately US4).
   2. Two (2) 3/8" - 16 x 3/4" oval head Spanner screws furnished for attaching; attachment holes are approximately 7-1/2" center to center; overall length, approximately 8-5/8"; hand hold, approximately 5-1/4" long; clearance between grip and door, approximately 1-1/2".
   3. Acceptable Manufacturers:
      a. Southern Steel # 212C.
      b. Brink No. 300021.
      c. Folger Adam # 2.
      d. Builder's Brass Works No. 600.

E. Door Pull: (Stainless Steel Surface Flat Offset)
   1. Material: Stainless Steel (US32D)
   2. Dimensions: 3-1/2" x 10-1/2".
   3. Four (4) 1/4" 20 x 5/16" oval head Spanner head screws furnished for attaching.
   4. Acceptable Manufacturers:
      a. Builder's Brass Works #5050 - 10-1/2" long.
      b. Baldwin #2590 - Mod. 10-1/2" long.
      c. Rockwood #91 Mod. - 10-1/2" long.

F. Door Pull: (Flush Pull)
   1. Material: Cast bronze, satin flush (US4) 4"W x 5"H x 1/8".
   2. Attach using four (4) oval head Spanner head (1/4" - 20 x 5/16").
   3. Acceptable Manufacturers:
      a. Southern Steel 21-B.
      b. Folger Adam #4.
      c. Brink 300011.
      d. Builder's Brass Works No. 5040-S.

G. Silencers: Gray rubber or neoprene, tamperproof 1/8" air cushion. Glynn Johnson 64 or equal. Provide weld plates on inside for all door silencers.

J. Heavy Duty, high security Mechanical Deadlock for swinging doors on holding cells; unlocking and locking by paracentric key only.
1. Forged steel case and rolled steel cover.
2. Solid steel spring bolt with two solid hardened tool steel inserts.
3. Five (5) spring temper hard brass lever tumblers, .10" thick.
4. Phosphor bronze springs.
5. Polished alloy bronze cylinder.
6. Automatic deadlock actuator.
7. Bolt throw 1".
8. Standard retracted bolt projection 1/2".
9. Spring bolt size 3/4" x 2".
10. Acceptable Manufacturers:
    a. BLS 7080 or equal.

K. Keeper for use with Mechanical Deadlock:
1. Mortise type with dust box (16 gauge hot rolled steel).
2. 3/16" hot rolled faceplate.
3. Four (4) 1/4-20 F.H. Spanner screws.
4. BLS 7080KD or equal

L. Food Pass/Cuff Port:
1. Provide food pass/cuff port on all holding cell doors.
2. The food pass shall have a clear opening approximately 4-1/2" x 15". Door to food pass shall be 1/4" plate and shall lap the opening 1/2" on the sides and the bottom and 3/4" at the top. The doors shall be hung on two (2) 3" tight pin hinges and locked with a Southern Steel Co. No. 1017, or an approved equal, mounted above the door. Provide lock reinforcement. A 3/8" bar stop shall be provided for the door to form a shelf when opened. Door is also to be provided with a combination lock boltkeeper and pull. Food pass is to be located on all holding cell doors

MQ. Provide 12 floor stops, Glynn-Johnson FB17 and 24 wall bumpers, Glynn-Johnson 50C/50W. Wall and floor stops locations shall be determined by Architect.

2.02 SECURITY HARDWARE SCHEDULE

A. Abbreviations
1. SS = Southern Steel Company
2. BLS = Brink Locking System
3. NG = National Guard
4. GJ = Glynn Johnson
5. BBW = Builder's Brass Works
6. PC = Prime Coat
7. SHS = Security Head Screws
8. GALV = Galvanized
9. LN = Locketics
10. SF = Southern Folger

11. RF = Rixson Firemark

SH-1 – Holding Cells -

(3) BLS #41/2 FMST - US32D	Hinges
(1) BLS 7080-1 x US26D x SHS	Lockset
(1) CUFF PORT LOCK BLS 7017	Lockset
(2) BLS #3FP x PC x SHS	Hinges
(1) BLS 9017-1 x US26D x SHS	Lockset

2.03 SECURITY SCREWS

A. All security hardware etc. shall have stainless steel torx head with center pin security screws.

PART 3 - EXECUTION

3.01 INSTALLATION

A. The electrical circuits for each and every locking system shall be tested by the representative of the security hardware manufacturer or supplier and shall be certified as having compatible voltage, protection against overload and duty cycle capability consistent with the operation and installation.

B. The security hardware manufacturer shall review the control consoles shop drawings, other devices, and systems as being compatible with all security hardware.

C. A complete system wiring diagram for all locks and controls shall be prepared by the manufacturer of the control consoles. These wiring diagrams shall be reviewed and approved by the security hardware manufacturer for correctness with respect to lock functions, monitoring requirements, number of conductors, and connection points. No deviations, modifications, or changes from the information contained in the approved shop drawings and wiring diagrams shall be allowed. In the event hardware manufacturing changes which occur after approval of shop drawings or wiring diagram require any additional costs to the Project, such additional costs shall be borne by the security hardware manufacturer.

D. The security hardware manufacturers shall review and approve all hollow metal door and frame shop drawings for proper acceptance of the security hardware. If modification must be made to the doors and frame during construction for proper hardware operation, there shall be no additional cost to the Owner.

END OF SECTION
THCLLC - January 27, 2025

SECTION 088000
GLAZING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Glazing units.

B. Glazing compounds.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealants for other than glazing purposes.

B. Section 081416 - Flush Wood Doors: Glazed lites in doors.

C. Section 084313 - Aluminum-Framed Storefronts: Glazing provided as part of storefront assembly.

1.03 REFERENCE STANDARDS

A. 16 CFR 1201 - Safety Standard for Architectural Glazing Materials; Current Edition.

B. ANSI Z97.1 - American National Standard for Safety Glazing Materials Used in Buildings - Safety Performance Specifications and Methods of Test; 2015 (Reaffirmed 2020).

C. ASTM C864 - Standard Specification for Dense Elastomeric Compression Seal Gaskets, Setting Blocks, and Spacers; 2005 (Reapproved 2019).

D. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.

E. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

F. ASTM C1172 - Standard Specification for Laminated Architectural Flat Glass; 2019.

G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016 (Reapproved 2023).

H. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2023.

I. ASTM E413 - Classification for Rating Sound Insulation; 2022.

J. GANA (SM) - GANA Sealant Manual; 2008.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data on Glazing Unit Glazing Types: Provide structural, physical and environmental characteristics, size limitations, special handling and installation requirements.

C. Product Data on Glazing Compounds and Accessories: Provide chemical, functional, and environmental characteristics, limitations, special application requirements, and identify available colors.

D. Warranty Documentation: Submit manufacturer warranty and ensure that forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years of documented experience.

B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

1.06 FIELD CONDITIONS

A. Do not install glazing when ambient temperature is less than 40 degrees F (4 degrees C).

B. Maintain minimum ambient temperature before, during and 24 hours after installation of glazing compounds.

1.07 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

B. Glass Units: Provide a five (5) year manufacturer warranty to include coverage for seal failure, interpane dusting or misting, including providing products to replace failed units.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Glass Fabricators:
   1. GGI - General Glass International; _____: www.generalglass.com/#sle.
   2. Standard Bent Glass Corp: www.standardbent.com/#sle.
   3. Tecnoglass; Insulating Glass: www.tecnoglass.com/#sle.
   4. Thompson I.G., LLC: www.thompsonig.com/#sle.
   5. Trulite Glass & Aluminum Solutions, LLC: www.trulite.com/#sle.
   6. Viracon, Inc: www.viracon.com/#sle.

2.02 GLASS MATERIALS

A. Float Glass: Provide float glass based glazing unless otherwise indicated.
   1. Kind FT - Fully Tempered Type: Complies with ASTM C1048.

B. Laminated Glass: Float glass laminated in accordance with ASTM C1172.
   1. Laminated Safety Glass: Complies with ANSI Z97.1 - Class B or 16 CFR 1201 - Category I impact test requirements.

2.03 GLAZING UNITS

A. Type G-2 - Monolithic Interior Vision Glazing:
   1. Applications: Interior glazing unless otherwise indicated.
   2. Glass Type: Fully tempered float glass.
   3. Tint: Clear.
   4. Thickness: 1/4 inch (6.4 mm), nominal.

B. Type G-18 - Sound Control Glazing: Laminated double insulating glass.
   1. Applications: Locations as indicated on drawings.
   2. Tint: Clear.
   3. Sound Transmission Class (STC) Rating: Provide at least STC 34 rating, complying with ASTM E90 and ASTM E413.
   4. Overall Thickness: 1 inch (25.4 mm).
   5. Laminated Double Insulating Glass:
      a. Outer Layer, Outboard Side: Tempered glass.
         1) Thickness: 3/16 inch (4.8 mm).
      b. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
      c. Outer Layer, Inboard Side: Tempered glass.
         1) Thickness: 3/16 inch (4.8 mm).
      d. Air Space: 1/2 inch (12.7 mm), filled with air.
      e. Inner Layer, Outboard Side: Annealed glass.
         1) Thickness: 1/4 inch (6.4 mm).
      f. Interlayer: Polyvinyl butyral (PVB), thickness as required to meet performance criteria.
      g. Inner Layer, Inboard Side: Annealed glass.
         1) Thickness: 1/4 inch (6.4 mm).

2.04 GLAZING COMPOUNDS

A. Type GC-1 - Glazing Putty: Polymer modified latex recommended by manufacturer for outdoor use, knife grade consistency; gray color.

B. Type GC-5 - Silicone Sealant: Single component; neutral curing; capable of water immersion without loss of properties; nonbleeding, nonstaining; ASTM C920 Type S, Grade NS, Class 25, Uses M, A, and G; with cured Shore A hardness range of 15 to 25; TBD color.

2.05 ACCESSORIES

A. Setting Blocks: Silicone, with 80 to 90 Shore A durometer hardness; ASTM C864 Option II. Length of 0.1 inch for each square foot (25 mm for each square meter) of glazing or minimum 4 inch (100 mm) by width of glazing rabbet space minus 1/16 inch (1.5 mm) by height to suit glazing method and pane weight and area.

B. Spacer Shims: Neoprene, 50 to 60 Shore A durometer hardness; ASTM C864 Option II. Continuous by one half the height of the glazing stop by thickness to suit application, self adhesive on one face.

2.06 SOURCE QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Provide shop inspection and testing for Type _____ glass.

PART 3 EXECUTION

3.01 VERIFICATION OF CONDITIONS

A. Verify that openings for glazing are correctly sized and within tolerances, including those for size, squareness, and offsets at corners.

B. Verify that surfaces of glazing channels or recesses are clean, free of obstructions that may impede moisture movement, weeps are clear, and support framing is ready to receive glazing system.

3.02 PREPARATION

A. Clean contact surfaces with appropriate solvent and wipe dry within maximum of 24 hours before glazing. Remove coatings that are not tightly bonded to substrates.

B. Seal porous glazing channels or recesses with substrate compatible primer or sealer.

C. Prime surfaces scheduled to receive sealant where required for proper sealant adhesion.

3.03 INSTALLATION, GENERAL

A. Install glazing sealants in accordance with ASTM C1193, GANA (SM), and manufacturer's instructions.

3.04 FIELD QUALITY CONTROL

A. See Section 014000 - Quality Requirements for additional requirements.

B. Glass and Glazing product manufacturers to provide field surveillance of the installation of their products.

C. Monitor and report installation procedures and unacceptable conditions.

3.05 CLEANING

A. Remove excess glazing materials from finish surfaces immediately after application using solvents or cleaners recommended by manufacturers.

B. Remove nonpermanent labels immediately after glazing installation is complete.

C. Clean glass and adjacent surfaces after sealants are fully cured.

D. Clean glass on both exposed surfaces not more than 4 days prior to Date of Substantial Completion in accordance with glass manufacturer's written recommendations.

3.06 PROTECTION

A. After installation, mark pane with an 'X' by using removable plastic tape or paste; do not mark heat absorbing or reflective glass units.

B. Remove and replace glass that is damaged during construction period prior to Date of Substantial Completion.

END OF SECTION

SECTION 088853 - SECURITY GLASS AND GLAZING

PART 1 - GENERAL

1.01 GENERAL

A. Related Documents
1. Work of this section shall conform to the requirements of the Contact Documents, including the General Conditions, Supplementary General Conditions, Special Conditions and Division 1 - General Requirements.
2. "Security Hollow Metal Doors and Frames" - Section 083643.
3. "Security" – All Sections 270000

B. Description
1. Furnish all labor, materials, tools, equipment necessary to complete all security glass and glazing work shown on the drawings and as specified herein.
2. Refer to the "Door Schedules" for requirements to Laboratory listed glazing.
3. Glass that is required by the contract documents to be Laboratory listed shall be required to have copies of test reports with the submittals.

1.02 APPLICABLE PUBLICATIONS: The publications listed below form a part of this specification to the extent referenced. The publications are referred to in the text by the basic designation only.

A. Federal Specifications (Fed. Spec.):
DD-G-451D: Glass, Float or Plate, Sheet, Figured (Flat, for Glazing, Mirrors and Other Uses)
DD-G-1403C: Glazing, Float, Sheet, Figured, Coated (Heat-Strengthened and Tempered)
TT-G-410E: Glazing Compound, Sash (Metal) for Back Bedding and Am 1 and Facing Glazing (Not for Channel or Stop Glazing)

B. Military Specification (Mil. Spec.):
MIL-R-900F: Rubber Gasket Material, 45 Durometer Hardness
MIL-P-46144B: Plastic Sheet, Polycarbonate

C. Consumer Products Safety Commission (CPSC) Publication:
16 CFR, Part 1201: Safety Standard for Architectural Glazing Materials

D. American Society for Testing and Materials (ASTM) Publications:
C 106-85: Standard Specification for Flat Glass
C 920-79: Elastomeric Joint Sealants
D 673-70: Mar Resistance of Plastics
D 790-84A: Test Method for Flexural Properties
D 1003-77: Test Method for Haze and Luminous Transmittance of Transparent Plastics
C 1048-85

E. American National Standard Institute
Z 26.1: Safety Code for Safety Glazing Materials (Test #1, #2, #3, #4, and #21)

F. American Architectural Manufacturer's Association (AAMA) Publication:
SC-1: Preformed Channels

G. National Fire Protection Association (NFPA) Publication:
80-81: Fire Doors and Windows
NFPA 252 - Fire Test of Door Assemblies
NFPA 257 - Fire Test of Window Assemblies

H. Flat Glass Marketing Association (FGMA) Publication:
1980: Glazing Manual
1970: Glazing Sealing Systems Manual (First Edition)

1.03 SUBMITTALS

A. Manufacturer's Data: Include glass manufacturer's printed literature for setting and sealing materials and for installation of each type of glazing material specified.

B. Samples: Two, 5 inches square, factory labeled, for each type of glass specified.

C. Certificates of Compliance: Certify or label each product to indicate that materials meet specified requirements.

D. Manufacturer's Guarantees: Guarantee glass units against development of material obstruction to vision as a result of delamination, other than through glass breakage, within a 10-year period following acceptance of the work. Provide new units for any units failing to comply with terms of this guarantee within 30 working days after receipt of notice from the Owner.

1.04 DELIVERY AND STORAGE

A. Deliver products to the site in unopened containers, labeled plainly with manufacturer's names and brands. Store glass and setting materials in safe, dry locations and do not unpack until needed for installation. Handle and install materials in a manner that will protect them from damage.

B. Protect glass and glazing materials during delivery, storage and handling, to comply with manufacturer's direction and as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, of temperature changes, of direct exposure to sun, and from other causes.

1.05 QUALITY ASSURANCE

A. Glazing Standard: Comply with recommendations of Flat Glass marketing Association (FGMA) "Glazing Manual" and "Sealant Manual" except where more stringent requirements are indicated. Refer to those publications for definitions of glass and glazing terms not otherwise defined in this section or other referenced standards.

B. Safety Glazing Standard: Where safety glass is indicated or required by authorities having jurisdiction, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of 16 CFR part 1201 for category II materials.

C. Fire-Resistance-Rated Wire Glass: Provide wire glass products that are identified to those tested per ASTM E 163 (UL 9) and are labeled and listed by UL or other testing and inspecting agency acceptable to authorities having jurisdiction.

D. Single Source Responsibility: Provide materials obtained from one source for each type of glass and glazing products indicated, and for visually related areas.

E. Manufacturer: Subject to compliance with requirements, provide products of one of the following:
   1. Manufacturer of Laminated Safety Glass:
      a. Global Security Glazing
      b. LTI Smartglass
      e. McGrory Glass
   2. Manufacturer of Compositional Glass:
      a. Global Security Glazing
      b. LTI Smartglass
      e. McGrory Glass
   3. Manufacturer of Laminated Polycarbonate:
      a. Global Security Glazing
      b. LTI Smartglass
      e. McGrory Glass

1.06 WARRANTY

A. Manufacturer's Warranty on Laminated Glass and Polycarbonate: Provide written warranty signed by manufacturer of laminated glass agreeing to furnish FOB point of manufacturer, freight allowed project site, within specified warranty period indicated below, laminated glass units which develop manufacturing defects.
Manufacturing defects are defined as edge separation delamination, or materially obstructed vision through glass. Warranty period for each type of laminated glass shall be as follows:
   1. Laminated Safety Glass: Manufacturer's standard but not less than 10 years after date of substantial completion.
   2. Laminated Security Compositional Glass: Manufacturer's standard but not less than 1 year after date of substantial completion.
   3. Bullet Resistant Glass: Manufacturer's standard but not less than 10 year after date of substantial completion.

PART 2 - PRODUCTS

2.01 HEAT-TREATED GLASS

A. Manufacturing Process: Manufacturer heat-treated glass as follows:
   1. By vertical (tong-held) or horizontal (roller hearth) process, at manufacturer's option.

B. Clear Tempered Float Glass: Grade B (fully tempered), style I (uncoated surfaces), type I (float), quality q3 (glazing quality), class 1 (transparent).

2.02 POLYCARBONATE SHEET GLASS

A. Shall be extruded monolithic polycarbonate sheet, UV stabilized coated on both faces with mar surface treatment. Product must conform with ICBD, BOCA, and SBCCI Model Building Codes as an approved light. Transmitting plastic with a CC-1 flammability performance level.

2.03 LAMINATED GLASS PRODUCTS

A. General: Refer to primary and chemically-treated glass requirements relating to properties of uncoated glasses making up laminated safety.

B. Plastic Interlayer: Provide glass fabricator's standard polyvinyl butyral interlayer for laminating panes of glass, with a proven record of showing no tendency to bubble, discolor or lose physical or mechanical properties after laminating and installation, in color and of thickness indicated. Interlayer thickness shall be as specified in glass types and of clear color.

C. Laminating Process: Fabricate laminated glass using laminator's standard heat-plus-pressure process to produce glass free from foreign substances and air/glass pockets.

2.04 LAMINATED POLYCARBONATE

A. Shall be extruded monolithic polycarbonate sheet, UV stabilized but laminated together using an interlayer of LR Resin. Thickness will vary according to manufacturer's requirements to meet finished product description in Section 2.8. Polycarbonate laminates shall have a flexural strength not less than 13,500 PSI; (ASTM D-790), 180 Degrees Fahrenheit allowable continuous service temperature. Products must conform with ICBO, BOCA, and SBCCI Model Building Codes as an approved light transmitting plastic with a CC-1 flammability performance level. Exterior surfaces shall be treated with a high mar-resistant, or equal coating. Abrasion resistance to be measured per ANSI 266.1 Test #17 (Taber Abrader).

2.05 POLYCARBONATE WITH MAR RESISTANT SURFACE TREATMENT

A. Shall be monolithic or laminated polycarbonate having a mar resistant surface, ASTM D-1044 Taber abrasion tested to 100 cycles and after 500 hours QUV weathering, change in haze no greater than 3.8%, change in light transmission no greater than 2%. In addition, after 1500 hours QUV 313B weatherability, results must meet or exceed the following: Light transmission: not to exceed 2%; YI 0-1500: change not to exceed 3.5%; % haze: not to exceed 3%. Coating integrity must be intact at the end of 1500 hours.

2.06 GLASS COMPOSITION

A. 1/2" Nominal, High Secure 3 ply laminate mar resistant polycarbonate, HP WhiteTP-0500.02 Level II step 15 rated, GE Lexgard MPC-500 or approved equal:
   1. 1/8" mar resistant polycarbonate
   2. .015 LR resin interlayer
   3. 1/4" polycarbonate
   4. .015 LR resin interlayer
   5. 1/8" mar resistant polycarbonate

   All glass and glazing shall have a 10-year warranty on delamination, surface failure & yellowing for all polycarbonates.

B. Holding Cell glass opening shall be minimum 23”x32”.

PART 3 - EXECUTION

3.01 INSTALLATION

A. Glazing Sealants:
   1. General: Comply with recommendation of sealant and glass manufacturers for selection of glazing sealants which have performance characteristics suitable for applications indicated and conditions at time of installation.
   2. Compatibility: Select sealants with proven compatibility with surfaces contacted in the installation and under service conditions indicated, as demonstrated by testing and field experience.
      a. Colors: Provide color of exposed sealant as selected by Architect from Chemically Strengthened Glass's standard colors.
      b. Silicone Glazing Sealant: Single component elastomeric silicone sealant complying with FS TT-S-001543, Class A, nonsag; and with ASTM C 920, Type S, Grade NS, Class 25, Use G and, as applicable to use indicated, Uses A and O; and with the following requirements:
         1) High-Modulus Silicone Glazing Sealant Manufacturer's standard high-modulus acid-curing sealant.
      c. Preformed Butylpolyisobutylene Glazing Tape: Blend of butylpolyisobutylene rubber with solids content of 100%, in extruded tape form, complying with AAMA 807.1, packaged on rolls with a release paper on side, with or without continuous spacer rod as recommended by manufacturers of tapes and glass for application indicated.

3.02 MISCELLANEOUS GLAZING MATERIALS

A. Compatibility: Provide materials with proven record of compatibility with surface contacted in installation.

B. Cleaners, Primers, and Sealers: Type recommended sealant or glass manufacturer.

C. Setting Blocks: Neoprene, EPDM, or silicone blocks as required for compatibility with glazing sealants, 80 to 90 Shore a durometer hardness.

D. Edge Block: Neoprene, EPDM, or silicone blocks as required for compatibility with glazing sealant, of size and hardness required to limit lateral movement (side-walking) of glass.

3.03 INSPECTION

A. Require Glazier to inspect work of glass framing erector for compliance with manufacturing and installation tolerances, including those for size, squareness, offsets at corners; for presence and functioning of weep system; for existence of minimum required face or edge clearances; and for effective sealing of joinery. Obtain Glazier's written report listing conditions detrimental to performance of glazing work. Do not allow glazing work to proceed unit unsatisfactory conditions have been corrected. Contractor to coordinate inspection with architect.

3.04 PREPARATION

A. Clean glazing channels and other framing members to receive glass, immediately before glazing. Remove coatings which are not firmly bonded to substrates. Remove lacquer form metal surfaces where elastomeric sealants are indicated for use.

3.05 GLAZING GENERAL

A. Comply with combined printed recommendations of glass manufacturers of sealants, gaskets, and other glazing materials, except where more stringent requirements are indicated, including those referenced glazing standards.

B. Glazing channel dimensions as detailed by supplier to provide for 1" bite on glass, minimum edge and face clearances, and adequate sealant thicknesses, with reasonable tolerances. Contractor must comply with manufacturer's recommendations and coordinate with hollow metal details.

C. Protect glass from edge damage during handling and installation; use a rolling block in rotating glass units to prevent damage to glass corners. Glass shall not impact metal framing. Use suction cups to shift glass units within openings; do not raise or shift glass with a pry bar. Rotate glass with flares or bevels along one horizontal edge which would occur in vicinity of setting blocks so that these are located at top of opening. Remove from project and dispose of glass units with edge damage or other imperfections of kind that, when installed, weakens glass and impairs performance and appearance.

D. Apply primers to joint surfaces where required for adhesion of sealants, as determined by sealant-substrate testing.

3.06 GLAZING

A. Install setting blocks of proper size in sill rabbet, located one-quarter of glass width from each corner, but no closer than 6" unless otherwise required. Set blocks in thin course of sealant which is acceptable for heel bead use.

B. Provide edge blocking to comply with requirements of referenced glazing standard, except where otherwise required by glass unit manufacturer.

C. Set units of glass in each series with uniformity of pattern, draw, bow, and similar characteristics.

D. Provide compressible filler rods or equivalent back-up material, as recommended by sealant and glass manufacturers, to prevent sealant from extruding into glass channel weep systems and from adhering to joints back surface as well as to control depth of sealant for optimum performance, unless otherwise indicated.

E. Force sealants into glazing channels to eliminate voids and to ensure complete "wetting" or bond or sealant to glass and channel surfaces.

F. Tool exposed surfaces of sealants to provide a substantial "wash" way from glass. Install pressurized tapes and gaskets to protrude slightly out of channel, so as to eliminate dirt and moisture pockets.

3.07 PROTECTION AND CLEANING

A. Protect exterior glass from breakage immediately upon installation by use of crossed streamers attached to framing and held away from glass. Do not apply markers to surfaces of glass. Remove nonpermanent labels and clean surfaces.

B. Protect glass from contact with contaminating substances resulting from construction operations. If, despite such protection, contaminating substances to come into contact with glass, remove immediately by method recommended by glass manufacturer.

C. Examine glass surfaces adjacent to or below exterior concrete and other masonry surfaces at frequent intervals during construction, but not less often than once a month, for build-up of dirt, scum, alkali deposits or staining. When examination reveals presence of these forms of residue, remove by method recommended by glass manufacturer.

D. Remove and replace glass which is broken, chipped, scratched, gouged, cut, cracked, abraded, or damaged in other ways during construction period, including natural causes, accidents, and vandalism.

E. Wash and clean glass, interior and exterior, on both faces not more than 4 days prior to date scheduled for inspections intended to establish data of substantial completion in each area of project. Wash glass by method recommended by glass manufacturer.

END OF SECTION
THCLLC - January 27, 2025

SECTION 090561
COMMON WORK RESULTS FOR FLOORING PREPARATION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
   1. Resilient tile and sheet.
   2. Carpet tile.
   3. Thin-set ceramic tile and stone tile.

B. Removal of existing floor coverings.

C. Preparation of new and existing concrete floor slabs for installation of floor coverings.

D. Patching compound.

1.02 RELATED REQUIREMENTS

A. Section 012200 - Unit Prices: Bid pricing for remediation treatments if required.

1.03 PRICE AND PAYMENT PROCEDURES

A. Alternates: See Section 012300 - Alternates.

1.04 REFERENCE STANDARDS

A. ASTM C109/C109M - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 50 mm [2 in.] Cube Specimens); 2023.

B. ASTM C472 - Standard Test Methods for Physical Testing of Gypsum, Gypsum Plasters, and Gypsum Concrete; 2020.

C. ASTM F710 - Standard Practice for Preparing Concrete Floors to Receive Resilient Flooring; 2022.

D. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2018.

1.05 SUBMITTALS

A. Visual Observation Report: For existing floor coverings to be removed.

B. Floor Covering and Adhesive Manufacturers' Product Literature: For each specific combination of substrate, floor covering, and adhesive to be used; showing:
   1. Moisture and alkalinity (pH) limits and test methods.
   2. Manufacturer's required bond/compatibility test procedure.

C. Adhesive Bond and Compatibility Test Report.

D. Copy of RFCI (RWP).

1.06 DELIVERY, STORAGE, AND HANDLING

A. Deliver, store, handle, and protect products in accordance with manufacturer’s instructions and recommendations.

B. Deliver materials in manufacturer’s packaging; include installation instructions.

C. Keep materials from freezing.

PART 2 PRODUCTS

2.01 MATERIALS

A. Patching Compound: Floor covering manufacturer's recommended product, suitable for conditions, and compatible with adhesive and floor covering. In the absence of any recommendation from flooring manufacturer, provide a product with the following characteristics:

1. Cementitious moisture-, mildew-, and alkali-resistant compound, compatible with floor, floor covering, and floor covering adhesive, and capable of being feathered to nothing at edges.
2. Compressive Strength: 3000 psi, minimum, after 28 days, when tested in accordance with ASTM C109/C109M or ASTM C472, whichever is appropriate.

PART 3 EXECUTION

3.01 CONCRETE SLAB PREPARATION

A. Perform following operations in the order indicated:
1. Existing concrete slabs with coatings or penetrating sealers/hardeners/dustproofers:
2. Preliminary cleaning.
3. Specified remediation, if required.
4. Patching, smoothing, and leveling, as required.
5. Other preparation specified.
6. Adhesive bond and compatibility test.
7. Protection.

3.02 REMOVAL OF EXISTING FLOOR COVERINGS

A. Comply with local, State, and federal regulations and recommendations of RFCI (RWP), as applicable to floor covering being removed.

B. Dispose of removed materials in accordance with local, State, and federal regulations and as specified.

3.03 PRELIMINARY CLEANING

A. Clean floors of dust, solvents, paint, wax, oil, grease, asphalt, residual adhesive, adhesive removers, film-forming curing compounds, sealing compounds, alkaline salts, excessive laitance, mold, mildew, and other materials that might prevent adhesive bond.

B. Do not use solvents or other chemicals for cleaning.

3.04 ADHESIVE BOND AND COMPATIBILITY TESTING

A. Comply with requirements and recommendations of floor covering manufacturer.

END OF SECTION

SECTION 092116
GYPSUM BOARD ASSEMBLIES - USG

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Metal stud wall framing.

B. Metal grid or channel ceiling framing.

C. Gypsum wallboard.

D. Cementitious backing board.

E. Joint treatment and accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 079200 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

1.03 REFERENCE STANDARDS

A. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2023.

B. ANSI A118.9 - American National Standard Specifications for Test Methods and Specifications for Cementitious Backer Units; 2023.

C. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.

D. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.

E. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2023.

F. ASTM C1047 - Standard Specification for Accessories for Gypsum Wallboard and Gypsum Veneer Base; 2019.

G. ASTM C1325 - Standard Specification for Fiber-Mat Reinforced Cementitious Backer Units; 2022, with Editorial Revision (2023).

H. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.

I. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2021.

J. GA-216 - Application and Finishing of Gypsum Panel Products; 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Include data on metal framing, gypsum board, glass mat faced gypsum board, and accessories.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 3 years of experience.

PART 2 PRODUCTS

2.01 WALL ASSEMBLY TYPES

A. See drawings for graphic representations of assemblies.

2.02 GYPSUM BOARD ASSEMBLIES

A. Provide completed assemblies complying with ASTM C840 and GA-216.

2.03 METAL FRAMING MATERIALS

A. Manufacturers - Metal Framing, Connectors, and Accessories:
   1. CEMCO; ____: www.cemcosteel.com/#sle.
   2. ClarkDietrich; ____: www.clarkdietrich.com/#sle.
   3. Marino; ____: www.marinoware.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Non-structural Framing System Components: ASTM C645; galvanized sheet steel, of size and properties necessary to comply with ASTM C754 for the spacing indicated, with maximum deflection of wall framing of L/120 at 5 psf (L/120 at 240 Pa).
   1. Studs: "C" shaped with knurled or embossed faces.
   2. Runners: U shaped, sized to match studs.

C. Partition Head To Structure Connections: Provide track fastened to structure with legs of sufficient length to accommodate deflection, for friction fit of studs cut short and fastened as indicated on drawings.

2.04 BOARD MATERIALS

A. Manufacturers - Gypsum-Based Board:
   1. USG Corporation: www.usg.com/#sle.

B. Gypsum Board: Paper-faced gypsum panels as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
   1. Application: Use for vertical surfaces and ceilings, unless otherwise indicated.
   2. Thickness:
      a. Vertical Surfaces: As indicated on drawings.
   3. Lightweight Board Products:
      a. USG Corporation; USG Sheetrock Brand UltraLight Panels Firecode ULX 5/8 in: www.usg.com/#sle.
   4. Paper-Faced Fire-Resistant Board Products:
      a. USG Corporation; USG Sheetrock Brand Firecode SCX Panels 5/8 in: www.usg.com/#sle.
   5. Moisture- and Mold-Resistant Paper-Faced Board Products:
      a. USG Sheetrock Brand Mold Tough Firecode SCX Panels 5/8 in: www.usg.com/#sle.

C. Backing Board For Wet Areas: One of the following products:
   1. Application: Surfaces behind tile in wet areas.
   2. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
   3. ANSI Cement-Based Board: Non-gypsum-based; aggregated Portland cement panels with glass fiber mesh embedded in front and back surfaces complying with or , suitable for decoration using natural stone or tile on walls, floors, or decks in wet and dry areas.
      a. Unfaced Products:
         1) USG Corporation; USG Durock Brand Cement Board with EdgeGuard 5/8 in: www.usg.com/#sle.

2.05 GYPSUM WALLBOARD ACCESSORIES

A. Beads, Joint Accessories, and Other Trim: ASTM C1047, rigid plastic, galvanized steel, or rolled zinc, unless otherwise indicated.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that project conditions are appropriate for work of this section to commence.

3.02 FRAMING INSTALLATION

A. Metal Framing: Install in accordance with ASTM C754 and manufacturer's instructions.

B. Suspended Ceilings and Soffits: Space framing and furring members as indicated.
   1. Level ceiling system to a tolerance of 1/1200.

2. Laterally brace entire suspension system.

C. Studs: Space studs at 16 inches on center (at 406 mm on center).
   1. Extend partition framing to structure where indicated and to ceiling in other locations.
   2. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.
   3. Partitions Terminating at Structure: Attach extended leg top runner to structure, maintain clearance between top of studs and structure, and brace both flanges of studs with continuous bridging.

D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.

E. Blocking: Install wood blocking for support of:
   1. Wall-mounted cabinets.
   2. Toilet partitions.
   3. Toilet accessories.
   4. Wall-mounted door hardware.

3.03 BOARD INSTALLATION

A. Comply with ASTM C840, GA-216, and manufacturer's instructions. Install to minimize butt end joints, especially in highly visible locations.

B. Cementitious Backing Board: Install over steel framing members and plywood substrate where indicated, in accordance with and manufacturer's instructions.

3.04 TOLERANCES

A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet (3 mm in 3 m) in any direction.

END OF SECTION

SECTION 093000
TILING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Tile for floor applications.

B. Tile for wall applications.

C. Cementitious backer board as tile substrate.

D. Ceramic accessories.

1.02 RELATED REQUIREMENTS

A. Section 079200 - Joint Sealants: Sealing joints between tile work and adjacent construction and fixtures.

B. Section 092116 - Gypsum Board Assemblies: Tile backer board.

1.03 REFERENCE STANDARDS

A. ANSI A108/A118/A136 - American National Standard Specifications for the Installation of Ceramic Tile (Compendium); 2024.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide manufacturers' data sheets on tile, mortar, grout, and accessories. Include instructions for using grouts and adhesives.

C. Samples: Mount tile and apply grout on two plywood panels, minimum 18 by 18 inches (457 by 457 mm) in size illustrating pattern, color variations, and grout joint size variations.

D. Installer's Qualification Statement:

E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
   1. See Section 016000 - Product Requirements, for additional provisions.
   2. Extra Tile: 10 square feet (1 square meters) of each size, color, and surface finish combination.

1.05 QUALITY ASSURANCE

A. Installer Qualifications:
   1. Company specializing in performing tile installation, with minimum of five years of documented experience.

PART 2 PRODUCTS

2.01 TILE

A. Manufacturers: All products by the same manufacturer.
   1. Dal-Tile Corporation; _____: www.daltile.com/#sle.
   2. Substitutions: See Section 016000 - Product Requirements.

2.02 TRIM AND ACCESSORIES

A. Ceramic Accessories: Glazed finish, same color and finish as adjacent field tile; same manufacturer as tile.

2.03 SETTING MATERIALS

A. Manufacturers:
   1. ARDEX Engineered Cements; _____: www.ardexamericas.com/#sle.
   2. Mapei Corporation; _____: www.mapei.com/#sle.
   3. Schluter-Systems; ____: www.schluter.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.04 GROUTS

END OF SECTION

SECTION 095100
ACOUSTICAL CEILINGS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Suspended metal grid ceiling system.

B. Acoustical units.

1.02 REFERENCE STANDARDS

A. ASTM C635/C635M - Standard Specification for Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2022.

B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-In Panels; 2019.

C. ASTM E580/E580M - Standard Practice for Installation of Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels in Areas Subject to Earthquake Ground Motions; 2022.

D. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2023.

1.03 ADMINISTRATIVE REQUIREMENTS

A. Sequence work to ensure acoustical ceilings are not installed until building is enclosed, sufficient heat is provided, dust generating activities have terminated, and overhead work is completed, tested, and approved.

B. Do not install acoustical units until after interior wet work is dry.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on suspension system components and acoustical units.

1.05 QUALITY ASSURANCE

A. Suspension System Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

B. Acoustical Unit Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.

1.06 FIELD CONDITIONS

A. Maintain uniform temperature of minimum 60 degrees F (16 degrees C), and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Acoustic Tiles/Panels:
   1. Armstrong World Industries, Inc; ____: www.armstrongceilings.com/#sle.
   2. Certainteed Architectural; ____: www.certainteed.com/ceilings-and-walls/#sle.
   3. USG Corporation; ____: www.usg.com/ceilings/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

B. Suspension Systems:
   1. Same as for acoustical units.

2.02 ACOUSTICAL UNITS

A. Acoustical Units - General: ASTM E1264, Class A.

B. Acoustical Tiles: Painted mineral fiber, with the following characteristics:
   1. Classification: ASTM E1264 Type III.
   2. Size: 24 by 24 inches (610 by 610 mm).
   3. Thickness: 3/4 inch (19 mm).

4. Tile Edge: Beveled.
   a. Joint: Kerfed and rabbeted.
5. Suspension System: Exposed grid.
6. Suspension System: Concealed.
7. Products: (Match Exisitng)
   a. Armstrong World Industries, Inc; Fine Fissured: www.armstrongceilings.com/#sle.

2.03 SUSPENSION SYSTEM(S)

A. Metal Suspension Systems - General: Complying with ASTM C635/C635M; die cut and interlocking components, with perimeter moldings, hold down clips, stabilizer bars, clips, and splices as required.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that layout of hangers will not interfere with other work.

3.02 PREPARATION

A. Install after major above-ceiling work is complete.

B. Coordinate the location of hangers with other work.

3.03 INSTALLATION - SUSPENSION SYSTEM

A. Install suspension system in accordance with ASTM C636/C636M, ASTM E580/E580M, and manufacturer's instructions and as supplemented in this section.

B. Rigidly secure system, including integral mechanical and electrical components, for maximum deflection of 1:360.

C. Suspension System, Non-Seismic: Hang suspension system independent of walls, columns, ducts, pipes and conduit. Where carrying members are spliced, avoid visible displacement of face plane of adjacent members.

D. Where ducts or other equipment prevent the regular spacing of hangers, reinforce the nearest affected hangers and related carrying channels to span the extra distance.

E. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.

F. Support fixture loads using supplementary hangers located within 6 inches (152 mm) of each corner, or support components independently.

G. Do not eccentrically load system or induce rotation of runners.

3.04 INSTALLATION - ACOUSTICAL UNITS

A. Install acoustical units in accordance with manufacturer's instructions.

B. Fit acoustical units in place, free from damaged edges or other defects detrimental to appearance and function.

C. Fit border trim neatly against abutting surfaces.

D. Install acoustical units level, in uniform plane, and free from twist, warp, and dents.

E. Cutting Acoustical Units:
   1. Make field cut edges of same profile as factory edges.

3.05 TOLERANCES

A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet (3 mm in 3 m).

B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

3.06 CLEANING

A. See Section 017000 - Execution and Closeout Requirements for additional requirements.

B. Clean surfaces.

C. Replace damaged or abraded components.

END OF SECTION

SECTION 096500
RESILIENT FLOORING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Resilient tile flooring.

B. Resilient base.

C. Installation accessories.

1.02 RELATED REQUIREMENTS

A. Section 090561 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

1.03 REFERENCE STANDARDS

A. ASTM F1700 - Standard Specification for Solid Vinyl Floor Tile; 2020.

B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2021.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; including sizes, patterns and colors available; and installation instructions.

C. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.

1.05 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

A. Upon receipt, immediately remove any shrink-wrap and check materials for damage and the correct style, color, quantity and run numbers.

B. Store all materials off of the floor in an acclimatized, weather-tight space.

1.07 FIELD CONDITIONS

A. Store materials for not less than 48 hours prior to installation in area of installation at a temperature of 70 degrees F (21 degrees C) to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F (13 degrees C).

PART 2 PRODUCTS

2.01 TILE FLOORING

A. Vinyl Tile -Basis of design or equal.

Shaw contract - terrace 2.5mm 4108v, color: midnight 08585, size: 12"x24", 20mil, installation: stagger

Shaw contract - thoughtful 5.0mm 4122v, color: vellum 4122v, size: 24"x24", 20mil, installation: quarter turn.

Shaw contract - unite ii, union 4349v, color: iron thatch 49720, size: 9"x48", 20mil, installation: brick

Shaw contract - unite ii, inlet ii 4372v, color: thatch 72720, 9"x48", 20mil, installation: brick

Shaw contract - unite ii, commingle 4350v, color: iron 50505, size: 9"x48", 20mil: .

1. Manufacturers:
   a. Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
   b. Mannington Commercial; _____: www.manningtoncommercial.com#sle.

c. Roppe Corporation; _____: www.roppe.com/#sle
d. Shaw.

2. Minimum Requirements: Comply with ASTM F1700, of Class corresponding to type specified.
3. Total Thickness: 0.125 inch (3 mm).
4. Color: To be selected by Architect from manufacturer's full range.

2.02 RESILIENT BASE

A. Resilient Base - : ASTM F1861, Type TS, rubber, vulcanized thermoset; style as scheduled.
1. Manufacturers:
a. Flexco Corporation; Base Sculptures: www.flexcofloors.com/#sle.
b. Johnsonite, a Tarkett Company; _____: www.johnsonite.com/#sle.
c. Mannington Commercial; _____: www.manningtoncommercial.com#sle.
d. Roppe Corporation; Contours Profiled Wall Base System: www.roppe.com/#sle.
e. Substitutions: See Section 016000 - Product Requirements.
2. Height: 4 inches (100 mm).
3. Thickness: 0.125 inch (3.2 mm).
4. Finish: Satin.
5. Color: As indicated on drawings.

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by adhesive material manufacturer.

B. Primers, Adhesives, and Seam Sealer: Waterproof; types recommended by flooring manufacturer.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are flat to tolerances acceptable to flooring manufacturer, free of cracks that might telegraph through flooring, clean, dry, and free of curing compounds, surface hardeners, and other chemicals that might interfere with bonding of flooring to substrate.

3.02 PREPARATION

A. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.

B. Prohibit traffic until filler is fully cured.

3.03 INSTALLATION - GENERAL

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install in accordance with manufacturer's written instructions.

3.04 INSTALLATION - TILE FLOORING

A. Mix tile from container to ensure shade variations are consistent when tile is placed, unless otherwise indicated in manufacturer's installation instructions.

3.05 INSTALLATION - RESILIENT BASE

A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches (45 mm) between joints.

B. Install base on solid backing. Bond tightly to wall and floor surfaces.

END OF SECTION

SECTION 096813
TILE CARPETING

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Carpet tile, fully adhered.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on specified products, describing physical and performance characteristics; sizes, patterns, colors available, and method of installation.

C. Shop Drawings: Indicate layout of joints.

D. Samples: Submit two carpet tiles illustrating color and pattern design for each carpet color selected.

1.03 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in installing carpet tile with minimum three years documented experience and approved by carpet tile manufacturer.

1.04 FIELD CONDITIONS

A. Store materials in area of installation for minimum period of 24 hours prior to installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Tile Carpeting:
1. Interface, Inc; ____: www.interface.com/#sle.
2. Mannington Commercial; _____: www.manningtoncommercial.com#sle.
3. Mohawk Group; ____: www.mohawkgroup.com/#sle.
4. Shaw Contract: ; ____: www.shawcontract.com/#sle

2.02 MATERIALS

A. Tile Carpeting, Type _____: Tufted, manufactured in one color dye lot.

B. Basis of design or preapproved equal:
1. Shaw contract - collection: bright work, allure tile 59327, color: starlight 27504, size: 24"x24" installation: quarter-turn
2. Shaw contract - collection: cultivate soul, adage tile 5t427, color: gracious 27429, size: 18"x36" installation: basketweave
3. Shaw contract - collection: journey, current tile 5t350, color: stormy 49516, size: 9"x36" installation: stagger

2.03 ACCESSORIES

A. Subfloor Filler: White premix latex; type recommended by flooring material manufacturer.

B. Edge Strips: Embossed aluminum, black color.

C. Carpet Tile Adhesive: Recommended by carpet tile manufacturer; releasable type.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that subfloor surfaces are dust-free and free of substances that could impair bonding of adhesive materials to subfloor surfaces.

3.02 PREPARATION

A. Prepare floor substrates as recommended by flooring and adhesive manufacturers.

3.03 INSTALLATION

A. Starting installation constitutes acceptance of subfloor conditions.

B. Install carpet tile in accordance with manufacturer's instructions.

C. Blend carpet from different cartons to ensure minimal variation in color match.

D. Cut carpet tile clean. Fit carpet tight to intersection with vertical surfaces without gaps.

E. Lay carpet tile in square pattern, with pile direction parallel to next unit, set parallel to building lines.

F. Locate change of color or pattern between rooms under door centerline.

G. Trim carpet tile neatly at walls and around interruptions.

H. Complete installation of edge strips, concealing exposed edges.

3.04 CLEANING

A. Remove excess adhesive without damage, from floor, base, and wall surfaces.

B. Clean and vacuum carpet surfaces.

END OF SECTION

SECTION 099000
PAINTING AND COATING - COMMERCIAL FACILITY GUIDE SPECIFICATION - SHERWIN-WILLIAMS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Surface preparation.

B. Interior painting and coating systems.

1.02 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Provide complete list of products to be used, with the following information for each:
   1. Product characteristics.
   2. Surface preparation instructions and recommendations.
   3. Primer requirements and finish specification.
   4. Storage and handling requirements and recommendations.
   5. Application methods.
   6. Clean-up information.

1.03 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

1.04 MOCK-UPS

A. See Section 014000 - Quality Requirements for general requirements for mock-ups.

B. Provide one accent wall as directed by Architect to demonstrate color and finish.

C. Locate where directed by Architect.

D. Mock-up may remain as part of the work.

1.05 FIELD CONDITIONS

A. Do not apply materials when environmental conditions are outside the ranges required by manufacturer.

B. Follow manufacturer's recommended procedures for producing the best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Basis of Design Products: Subject to compliance with requirements, provide Sherwin-Williams Company (The) products indicated; www.sherwin-williams.com/#sle.

B. Comparable Products: Products of approved manufacturers will be considered in accordance with 016000 - Product Requirements, and the following:
   1. Products are approved by manufacturer in writing for application specified.
   2. Products that meet or exceed performance and physical characteristics of basis of design products.

2.02 PAINTINGS AND COATINGS

A. General:
   1. Provide factory-mixed coatings unless otherwise indicated.
   2. Do not reduce, thin, or dilute coatings or add materials to coatings unless specifically indicated in manufacturer's instructions.

B. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

2.03 PAINT SYSTEMS - INTERIOR

A. Masonry CMU: Concrete, split face, scored, smooth, high density, low density, and fluted.
   1. Latex Systems:
      a. Semi-Gloss Finish:
         1) 1st Coat: Sherwin-Williams PrepRite Block Filler, B25W25: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 Zero VOC Latex Semi-Gloss, B31-2600 Series: www.sherwin-williams.com/#sle.

B. Drywall: Walls, ceilings, gypsum board, and similar items.
   1. Latex Systems:
      a. Semi-Gloss Finish High Performance (HP):
         1) 1st Coat: Sherwin-Williams ProMar 200 Zero VOC Interior Latex Primer, B28W2600: www.sherwin-williams.com/#sle.
         2) 2nd and 3rd Coat: Sherwin-Williams ProMar 200 HP Zero VOC Latex Semi-Gloss, B31-1950 Series: www.sherwin-williams.com/#sle.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

B. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

3.02 PREPARATION

A. Clean surfaces thoroughly and correct defects prior to application.

B. Prepare surfaces using the methods recommended by the manufacturer for achieving the best result for the substrate under the project conditions.

C. Gypsum Board: Fill minor defects with filler compound; sand smooth and remove dust prior to painting.

3.03 APPLICATION

A. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

B. Apply products in accordance with manufacturer's written instructions.

C. Apply coatings at spread rate required to achieve manufacturer's recommended dry film thickness.

3.04 PRIMING

A. Apply primer to all surfaces unless specifically not required by coating manufacturer. Apply in accordance with coating manufacturer's instructions.

B. Primers specified in painting schedules may be omitted on items that are factory primed or factory finished if acceptable to top coat manufacturers.

3.05 CLEANING

A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

B. Clean surfaces immediately of overspray, splatter, and excess material.

C. After coating has cured, clean and replace finish hardware, fixtures, and fittings previously removed.

3.06 PROTECTION

A. Protect finished coatings from damage until completion of project.

B. Touch-up damaged finishes after Substantial Completion.

END OF SECTION

SECTION 099300
STAINING AND TRANSPARENT FINISHING

PART 2 PRODUCTS

1.01 STAINS AND TRANSPARENT FINISHES - GENERAL

A. Finishes:
   1. Provide finishes capable of being readily and uniformly dispersed to a homogeneous coating, with good flow and brushing properties, and capable of drying or curing free of streaks or sags.
   2. Provide materials compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
   3. Supply each finish material in quantity required to complete entire project's work from a single production run.
   4. Do not reduce, thin, or dilute finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.

END OF SECTION

SECTION 102113.17
PHENOLIC TOILET COMPARTMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Phenolic toilet compartments.

B. Urinal and vestibule screens.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Blocking and supports.

B. Section 102800 - Toilet, Bath, and Laundry Accessories.

1.03 REFERENCE STANDARDS

A. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordination: Coordinate the work with placement of support framing and anchors in walls and ceilings.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide data on panel construction, hardware, and accessories.

C. Samples: Submit two samples of partition panels, in standard sample size illustrating panel finish, color, and sheen.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Phenolic Toilet Compartments:
   1. ASI Accurate Partitions; _____: www.asi-accuratepartitions.com/#sle.
   2. ASI Global Partitions; _____: www.asi-globalpartitions.com/#sle.
   3. Partition Systems International of South Carolina; Phenolic Toilet Partitions: www.psisc.com/#sle.

2.02 PHENOLIC TOILET COMPARTMENTS

A. Toilet Compartments: Factory fabricated doors, pilasters, and divider panels made of solid phenolic core panels with integral melamine finish, floor-mounted unbraced.

2.03 ACCESSORIES

A. Pilaster Shoes: Formed ASTM A666 Type 304 stainless steel with No. 4 finish, 3 inch (76 mm) high, concealing floor fastenings.

B. Wall and Pilaster Brackets: Polished stainless steel; manufacturer's standard type for conditions indicated on drawings.

C. Attachments, Screws, and Bolts: Stainless steel , tamper proof type.

D. Hardware: Polished stainless steel:
   1. Pivot hinges, gravity type, adjustable for door close positioning; two per door.
   2. Door Latch: Slide type.
   3. Door strike and keeper with rubber bumper; mounted on pilaster in alignment with door latch.
   4. Coat hook with rubber bumper; one per compartment, mounted on door.
   5. Provide door pull for outswinging doors.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify correct spacing of and between plumbing fixtures.

C. Verify correct location of built-in framing, anchorage, and bracing.

3.02 INSTALLATION

A. Install partitions secure, rigid, plumb, and level in accordance with manufacturer's instructions.

B. Maintain 3/8 inch to 1/2 inch (9 mm to 13 mm) space between wall and panels and between wall and end pilasters.

C. Attach panel brackets securely to walls using anchor devices.

D. Attach panels and pilasters to brackets. Locate head rail joints at pilaster center lines.

3.03 TOLERANCES

A. Maximum Variation From True Position: 1/4 inch (6 mm).

B. Maximum Variation From Plumb: 1/8 inch (3 mm).

3.04 ADJUSTING

A. Adjust and align hardware to uniform clearance at vertical edge of doors, not exceeding 3/16 inch (5 mm).

B. Adjust adjacent components for consistency of line or plane.

END OF SECTION

SECTION 102600
WALL AND DOOR PROTECTION

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Corner guards.

1.02 RELATED REQUIREMENTS

A. Section 092116 - Gypsum Board Assemblies: Placement of supports in stud wall construction.

1.03 SUBMITTALS

A. See Section 013000 - Administrative Requirements for submittal procedures.

B. Product Data: Indicate physical dimensions, features, and anchorage details.

C. Samples: Submit samples illustrating component design, configurations, joinery, color and finish.

1.04 DELIVERY, STORAGE, AND HANDLING

A. Store products in either horizontal or vertical position, in compliance with manufacturer's instructions.

1.05 WARRANTY

A. See Section 017800 - Closeout Submittals for additional warranty requirements.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Bumper Rails and Corner Guards:
   1. Construction Specialties, Inc; Acrovyn Solid Color and Chameleon Crash Rails: www.c-sgroup.com/#sle.
   2. Inpro; _____: www.inprocorp.com/#sle.
   3. Koroseal Interior Products; _____: www.koroseal.com/#sle.

2.02 PRODUCT TYPES

A. Corner Guards - Surface Mounted:
   1. Material: High impact vinyl with full height extruded aluminum retainer.
   2. Width of Wings: 2 inches (51 mm).
   3. Corner: Square.
   4. Color: As selected from manufacturer's standard colors.
   5. Length: One piece.

2.03 FABRICATION

A. Fabricate components with tight joints, corners and seams.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify that rough openings, concealed blocking, and anchors are correctly sized and located.

B. Verify that substrate surfaces for adhered items are clean and smooth.

3.02 INSTALLATION

A. Install components in accordance with manufacturer's instructions, level and plumb, secured rigidly in position to supporting construction.

B. Position corner guard to match existing and in similar locations as existing.

3.03 CLEANING

A. Clean wall and door protection items of excess adhesive, dust, dirt, and other contaminants.

END OF SECTION

SECTION 102800
TOILET, BATH, AND LAUNDRY ACCESSORIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Commercial toilet accessories.

B. Institutional ligature-resistant toilet accessories.

C. Utility room accessories.

1.02 RELATED REQUIREMENTS

A. Section 093000 - Tiling: Ceramic washroom accessories.

B. Section 224000 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

1.03 REFERENCE STANDARDS

A. ADA Standards - 2010 ADA Standards for Accessible Design; 2010.

B. ASTM A269/A269M - Standard Specification for Seamless and Welded Austenitic Stainless Steel Tubing for General Service; 2022.

C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2023.

D. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2023.

E. ASTM B456 - Standard Specification for Electrodeposited Coatings of Copper Plus Nickel Plus Chromium and Nickel Plus Chromium; 2017 (Reapproved 2022).

F. ASTM C1036 - Standard Specification for Flat Glass; 2021.

G. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.

H. ASTM C1503 - Standard Specification for Silvered Flat Glass Mirror; 2024.

I. ASTM F2285 - Standard Consumer Safety Performance Specification for Diaper Changing Tables for Commercial Use; 2022.

1.04 ADMINISTRATIVE REQUIREMENTS

A. Coordinate the work with the placement of internal wall reinforcement, concealed ceiling supports, and reinforcement of toilet partitions to receive anchor attachments.

1.05 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Commercial Toilet, Shower, and Bath Accessories:
   1. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
   2. Bradley Corporation; _____: www.bradleycorp.com/#sle.
   3. Georgia-Pacific Professional; _____: www.gppro.com/#sle.
   4. Substitutions: Section 016000 - Product Requirements.

B. Institutional Security and Ligature-Resistant Toilet and Bath Accessories:
   1. American Specialties, Inc; _____: www.americanspecialties.com/#sle.
   2. Whitehall Manufacturing; _____: www.whitehallmfg.com/#sle.
   3. Substitutions: Section 016000 - Product Requirements.

C. Electric Hand/Hair Dryers:

1. American Specialties, Inc; Safe-Dri: www.americanspecialties.com/#sle.
2. Dyson Inc; Dyson Airblade V: www.dyson.com/#sle.
3. Excel Dryer; XLERATOR: www.exceldryer.com/#sle.

D. Diaper Changing Stations:
1. American Specialties, Inc; 9013-9: www.americanspecialties.com/#sle.
2. Bradley Corporation; 962-11: www.bradleycorp.com/#sle.
3. Koala Kare Products; KB310-SSWM: www.koalabear.com/#sle.
4. Substitutions: 016000 - Product Requirements.

2.02 MATERIALS

A. Accessories - General: Shop assembled, free of dents and scratches and packaged complete with anchors and fittings, steel anchor plates, adapters, and anchor components for installation.

B. Keys: Provide _____ keys for each accessory to Owner; master key lockable accessories.

C. Stainless Steel Sheet: ASTM A666, Type 304.

D. Stainless Steel Tubing: ASTM A269/A269M, Grade TP304 or TP316.

E. Galvanized Sheet Steel: Hot-dipped galvanized steel sheet, ASTM A653/A653M, with G90/Z275 coating.

F. Mirror Glass: Annealed float glass, ASTM C1036 Type I, Class 1, Quality Q2, with silvering, protective and physical characteristics complying with ASTM C1503.

G. Mirror Glass: Tempered safety glass, ASTM C1048; and ASTM C1036 Type I, Class 1, Quality Q2, with silvering as required.

H. Adhesive: Two component epoxy type, waterproof.

I. Fasteners, Screws, and Bolts: Hot dip galvanized; tamper-proof; security type.

2.03 FINISHES

A. Stainless Steel: Satin finish, unless otherwise noted.

B. Chrome/Nickel Plating: ASTM B456, SC 2, polished finish, unless otherwise noted.

C. Baked Enamel: Pretreat to clean condition, apply one coat primer and minimum two coats epoxy baked enamel.

D. Powder-Coated Steel: Clean, degrease, and neutralize. Follow immediately with a phosphatizing treatment, prime coat, and two finish coats of powder coat enamel.

E. Back paint components where contact is made with building finishes to prevent electrolysis.

2.04 COMMERCIAL TOILET ACCESSORIES

A. Toilet Paper Dispenser: To Match Existing

B. Paper Towel Dispenser: To Match Existing.
1. Capacity: 500 multifold minimum.

C. Waste Receptacle: Stainless steel, freestanding style with swing top.
1. Minimum capacity: 10 gallons (38 liters).

D. Soap Dispenser: To Match Existing

E. Mirrors: Stainless steel framed, 1/4 inch (6 mm) thick annealed float glass; ASTM C1036.
1. Annealed Float Glass: Silvering, protective and physical characteristics in compliance with ASTM C1503.
2. Frame: 0.05 inch (1.3 mm)angle shapes, with mitered and welded and ground corners, and tamperproof hanging system; satin finish.

F. Grab Bars: Stainless steel, smooth surface.
1. Standard Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.

b. Dimensions: 1-1/4 inch (32 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, exposed flange mounting, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar.
c. Finish: Satin.
d. Length and Configuration: As indicated on drawings.

G. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.

2.05 INSTITUTIONAL SECURITY AND LIGATURE-RESISTANT TOILET AND BATH ACCESSORIES

A. Toilet Paper Holder: To Match Existing

B. Mirrors: Unframed, Type 400 polished stainless steel mirror; exposed front mount.

C. Grab Bars: Type 304 stainless steel, smooth surface with closure plate.
1. Standard Duty Grab Bars:
a. Push/Pull Point Load: 250 pound-force (1112 N), minimum.
b. Dimensions: 1-1/2 inch (38 mm) outside diameter, minimum 0.05 inch (1.3 mm) wall thickness, 1-1/2 inch (38 mm) clearance between wall and inside of grab bar; 14 gauge stainless steel "L" shaped closure plate with wall mounting flange welded to bottom of tube to prevent ligature. Install grab bar and closure plate with tamper-resistant screws through grab bar circular mounting flange and wall flange of flat closure.
c. Length and Configuration: As indicated on drawings.

2.06 UTILITY ROOM ACCESSORIES

A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch (1.3 mm) thick stainless steel, Type 304, with 1/2 inch (12 mm) returned edges, 0.06 inch (1.6 mm) steel wall brackets.
1. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
2. Length: Manufacturer's standard length for number of holders/hooks.

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify exact location of accessories for installation.

C. For electrically-operated accessories, verify that electrical power connections are ready and in the correct locations.

D. Verify that field measurements are as indicated on drawings.

E. See Section _____ for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

3.02 PREPARATION

A. Deliver inserts and rough-in frames to site for timely installation.

B. Provide templates and rough-in measurements as required.

3.03 INSTALLATION

A. Install accessories in accordance with manufacturers' instructions in locations indicated on drawings.

B. Install plumb and level, securely and rigidly anchored to substrate.

C. Mounting Heights: As required by accessibility regulations, unless otherwise indicated.

3.04 PROTECTION

A. Protect installed accessories from damage due to subsequent construction operations.

END OF SECTION

SECTION 104400
FIRE PROTECTION SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

A. Fire extinguishers.

B. Fire extinguisher cabinets.

C. Accessories.

1.02 RELATED REQUIREMENTS

A. Section 061000 - Rough Carpentry: Wood blocking product and execution requirements.

B. Section 099123 - Interior Painting: Field paint finish.

1.03 REFERENCE STANDARDS

A. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2023a.

B. NFPA 10 - Standard for Portable Fire Extinguishers; 2022.

1.04 SUBMITTALS

A. See Section 013000 - Administrative Requirements, for submittal procedures.

B. Shop Drawings: Indicate locations of cabinets and cabinet physical dimensions.

1.05 FIELD CONDITIONS

A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

PART 2 PRODUCTS

2.01 MANUFACTURERS

A. Fire Extinguishers:
   1. Activar Construction Products Group, Inc. - JL Industries; Cosmic Extinguisher - Multipurpose Chemical: www.activarcpg.com/#sle.
   2. Kidde, a unit of United Technologies Corp; _____: www.kidde.com/#sle.
   3. Oval Brand Fire Products; Oval Dry Chemical Fire Extinguisher - Multipurpose ABC: www.ovalfireproducts.com/#sle.
   4. Potter-Roemer; _____: www.potterroemer.com/#sle.
   5. Substitutions: See Section 016000 - Product Requirements.

B. Fire Extinguisher Cabinets and Accessories:
   1. Activar Construction Products Group, Inc. - JL Industries; Ambassador Series: www.activarcpg.com/#sle.
   2. Larsen's Manufacturing Co; _____: www.larsensmfg.com/#sle.
   3. Potter-Roemer; _____: www.potterroemer.com/#sle.
   4. Substitutions: See Section 016000 - Product Requirements.

2.02 FIRE EXTINGUISHERS

A. Fire Extinguishers - General: Comply with product requirements of NFPA 10 and applicable codes, whichever is more stringent.

B. Multipurpose Dry Chemical Type Fire Extinguishers: Carbon steel tank, with pressure gauge.
   1. Class: A:B:C type.
   2. Temperature range: Minus 40 degrees F (Minus 40 degrees C) to 120 degrees F (49 degrees C).

2.03 FIRE EXTINGUISHER CABINETS

A. Cabinet Construction: Non-fire rated.
   1. Formed primed steel sheet; 0.036 inch (0.9 mm) thick base metal.

B. Cabinet Configuration: Recessed type.
   1. Size to accommodate accessories.
   2. Trimless type.

C. Door: 0.036 inch (0.9 mm) metal thickness, reinforced for flatness and rigidity with nylon catch. Hinge doors for 180 degree opening with two butt hinges.

D. Door Glazing: Acrylic plastic, clear, 1/8 inch (3 mm) thick, flat shape and set in resilient channel glazing gasket.

E. Cabinet Mounting Hardware: Appropriate to cabinet, with pre-drilled holes for placement of anchors.

F. Fabrication: Weld, fill, and grind components smooth.

G. Finish of Cabinet Interior: White colored enamel.

2.04 ACCESSORIES

A. Extinguisher Brackets: Formed steel, chrome-plated.

B. Lettering: “FIRE EXTINGUISHER” decal, or vinyl self-adhering, prespaced black lettering in accordance with authorities having jurisdiction (AHJ).

PART 3 EXECUTION

3.01 EXAMINATION

A. Verify rough openings for cabinet are correctly sized and located.

3.02 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Secure rigidly in place.

3.03 MAINTENANCE

A. See Section 017000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

END OF SECTION

SECTION 21 0510 - GENERAL FIRE SUPPRESSION REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Quality Assurance Requirements and Installer Qualifications

C. Regulatory Requirements indicating applicable Codes, Ordinances and Regulations.

D. Submittal Procedures Supplementing Section 01 3300.

E. Operating and Maintenance Manuals

F. Execution Requirements common to Division 21 systems

G. Pipe Sleeves within building

H. Pipe Sleeves in footings and foundations

I. Piping Pressure Tests.

J. Equipment bases and housekeeping pads

K. Cleaning Requirements.

L. Finishing Requirements

1.2 RELATED SECTIONS

A. Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Section 01 7700 - Closeout Procedures, for additional warranty requirements.

C. Section 07 8400 - Firestopping.

D. Section 07 9200 - Joint Sealants

E. Section 09 9100 - Painting.

1.3 ALTERNATIVES

A. Refer to Section 01 2300 - Alternatives, for product alternatives affecting this Division.

1.4 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

F. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

G. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

H. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

I. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

J. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Design Professional shall be the instructor or shall be notified, as the case exists.

K. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

1.5 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.

D. Permits: Obtain all permits, paying all fees in connection therewith. At completion, have work inspected by proper authorities and furnish the Design Professional for the Owner an inspection certificate showing approval of installation.

E. Fire Protection: Conform to the Georgia State Minimum Standard Fire Code (International Fire Code), 2018 Edition, with all Georgia State Amendments.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2018 Edition, with all Georgia State Amendments, for all work involving cutting and welding.

G. Energy: Conform to the Georgia State Energy Code for Buildings (International Energy Conservation Code), 2015 Edition, with (2020),(2022) & (2023) Georgia State Amendments.

H. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 1, 2020".

I. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2023.

J. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2018 Edition with (2020), (2022), (2024) & (2025) Georgia State Amendments.

1.6 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.7 SUBMITTALS

A. Supplementing Division 1 requirements; the Contractor shall:

1. Review the submittal data and check to ensure compliance with specifications prior to submitting.

a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Design Professional are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.

b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal and in letter form to the Design Professional any and all deviations from the Contract Documents.

c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and

Resubmit" (acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.

d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.

2. Assemble the submittal data in compete sets in hard back three-ring binders, and bound with numbered index sheets and tabs. Submittal data shall be submitted at one time unless unavailable data would delay project progress. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points.

3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.

4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

5. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.

6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

7. Deliver submittals to the Design Professional at the business address.

8. Digital Delivery of Submittals:

a. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and a password.

b. Prepare the submittals as described above in Sections 1.7.A.1-7. Provide one pdf file for each specification section including all submittal data for that specification section. Provide labels identifying each piece of equipment, piping, or accessory to match the listed item in the specification. Take steps to reduce submittal file size.

c. Do not scan in color or high resolution unless required for clarity.

d. Ensure any reproductions are legible.

e. Send an email to submittal@nbpengineers.com with a copy to all Design Professionals identified during the preconstruction phase.

f. Identify the submittal using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building-Section 21 1300 - Fire Suppression Sprinklers.

g. Identify the submittal in the email subject line using the same information listed above.

h. Provide a submittal index.

i. Each pdf should include bookmarks to each product, and specification section to easily navigate the pdf file.

j. Ensure any submittal posted to NBP's or other FTP site has the same identification.

k. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.

B. Product Data:

1. Provide data specific to the Product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.

2. Manufacturer's standard drawings shall be modified by deletions or additions to show only items applicable to this project.

C. Warranty: Submit the Contractor's warranty letter addressed to the Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of Material Completion.

1.8 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for review a minimum of prior to the request for Material Completion.

B. Digital delivery of Operating and Maintenance Manuals:

1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.

2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.

3. Do not scan in color or high resolution unless required for clarity.

4. Ensure any reproductions are legible.

5. Send an email to submittal@nbpengineers.com with a copy to the Fire Protection Design Professional and the Architectural Design Professional (if applicable) identified during the preconstruction phase.

6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.

7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.

8. The O&M Pdf should contain bookmarks to each section of the manual, and bookmarks to each product.

9. Ensure the manuals posted to the FTP site has the same identification.

10. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Physical delivery of Operating and Maintenance Manuals:

1. Three (3) bound and indexed Operating and Maintenance Manuals shall be submitted for review. Two (2) approved copies shall be delivered to the operating personnel.

2. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.

3. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.

4. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.

5. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.

6. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

D. Each Manual shall contain the following information, data and drawings:

1. Copies of all submittals (with Design Professional's review comments and stamp), equipment and materials.

2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.

3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.

4. One copy of NFPA 25.

5. One Copy of as-built shop drawings showing layouts and construction details.

6. One copy of hydraulic calculations.

7. Copies of all certification, test certificates, and warranties.

1.9 QUALITY ASSURANCE

A. Fire Protection Installer Qualifications:

1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.

2. Refer to the individual sections within this division for additional installer qualification requirements.

3. Fire Protection

a. The contractor expressly warrants that the company performing the installation of the fire protection systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least 10 commercial or institutional buildings, each containing minimum of 10,000 ft2 of protected area or greater.

b. The contractor further warrants that the aforesaid subcontractor has trained personnel, instruments, tools, and equipment to perform the installation specified.

c. The Contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least the previous five consecutive years in the state of Georgia.

d. Provide a certificate of competency as issued by the Georgia State Fire Marshal's Office.

1.10 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products up off the floor, in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.11 WARRANTY

A. Refer to Section 01 7700- Closeout Procedures, for additional warranty requirements.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

C. Correct defective Work for a one year period after Date of Material Completion.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Design Professional for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, sprinkler heads, and some pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:

1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.

2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.

3. All equipment requiring service shall be made accessible. Coordinate piping and sprinkler head installation to avoid conflict with other trades.

C. Where new work is specified tying into old work and materials are different from existing, the contractor shall request a clarification from the Design Professional prior to performing the work.

3.3 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by fire protection systems so that no sprinkler piping, or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Route piping to avoid skylights, translucent, and transparent ceilings.

E. Pipe Sleeves in Slabs, Masonry Walls and Partitions:

1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.

2. Omit sleeves on steel pipe through slabs on grade.

3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.

4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.

5. Omit sleeves in openings core drilled in masonry partitions.

6. Rated Drywall Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.

7. Non-Rated Drywall Partitions: Omit sleeves.

F. Pipe sleeves in footings and foundation walls:

1. Schedule 40 black steel pipe.

2. Fire Protection water pipe, distribution piping, passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.

3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

G. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400 - Firestopping.

H. Seal sleeves and openings in exterior walls vaportight or watertight as applicable. Refer to Section 07 9200 - Joint Sealants.

I. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" galvanized steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

J. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.4 INTERFACE WITH OTHER WORK

A. Space Conditioning during construction:

1. Coordinate with the contractor regarding the limits of space conditions specified in other trade sections. Assist the Contractor in the preparation of the construction schedule.

3.5 PIPING PRESSURE TESTS

A. General:

1. Provide 48 hours notification to the Design Professional in advance of any test.

2. Complete tests prior to installing ceiling. Leaks shall be repaired, defective materials replaced, and system shall be retested. Strike all joints in copper and steel piping under a pressure test. Conduct tests prior to connecting to equipment or isolate equipment from system.

3. No water pressure test shall be conducted in freezing weather where subject to freezing.

4. Test shall be maintained at conditions specified until approved but, in no event, for less than two (2) hours minimum duration, unless otherwise noted.

5. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

6. Test pressures shall be read from a gauge located at the low elevation point of the system being tested.

3.6 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4-inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted.

D. Height:

1. Pumps on Grade: 4-inch concrete base.

2. Concrete curb at all pipe penetrations of floors in mechanical rooms above grade: 4-inches or as shown on plans.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.7 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Final Observation.

B. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

C. Chipped or scraped paint shall be retouched to match original finish.

D. Clean and polish all equipment nameplates. All nameplate information shall be legible.

E. All equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Final Observation.

3.8 FINISHING MECHANICAL EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all exposed pipes, unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish or in mechanical rooms shall be painted to prevent rust.

END OF SECTION

SECTION 21 1100 - FIRE SUPPRESSION PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, fittings, valves, and connections for sprinkler systems.

1.2 RELATED SECTIONS

A. Section 21 0510 - General Fire Suppression Requirements

B. Section 21 1300 - Fire-Suppression Sprinkler Systems: Sprinkler systems design.

C. Section 21 1200 - Fire-Suppression Standpipes: Standpipe design.

1.3 REFERENCES

A. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

B. ASME B16.4 - Gray Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).

C. ASME B16.5 - Pipe Flanges and Flanged Fittings; The American Society of Mechanical Engineers; 2003 (ANSI/ASME B16.5).

D. ASTM A 47/A 47M - Standard Specification for Ferritic Malleable Iron Castings; 1999 (Reapproved 2004).

E. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2006a.

F. ASTM A 135/A 135M - Standard Specification for Electric-Resistance Welded Steel Pipe; 2006.

G. ASTM A 795/A 795M - Standard Specification for Black and Hot-Dipped Zinc-Coated (Galvanized) Welded and Seamless Steel Pipe for Fire Protection Use; 2004.

H. AWWA C110/A21.10 - American National Standard for Ductile-Iron and Gray-Iron Fittings, 3 In. Through 48 In. (75 mm Through 1200 mm), for Water and Other Liquids; American Water Works Association; 2003.

I. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; American Water Works Association; 2007 (ANSI/AWWA C111/A21.11).

J. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast, for Water; American Water Works Association; 2002 (ANSI/AWWA C151/A21.51).

K. NFPA 13 - Standard for the Installation of Sprinkler Systems; National Fire Protection Association; 2019.

L. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association ; 2019.

M. NFPA 24 - Standard for the Installation of Private Fire Service Mains and Their Appurtenances; National Fire Protection Association; 2019.

N. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2017.

O. NFPA 72 - National Fire Alarm Code; 2019.

P. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2018 with all Georgia State Amendments.

Q. NFPA 291 - Recommended Practice for Fire Flow Testing and Marking of Hydrants; 2018.

R. Georgia State Minimum Standard Fire Prevention Code, 2018 Edition, with all Georgia State Amendments.

S. UL (FPED) - Fire Protection Equipment Directory; Underwriters Laboratories Inc.; current edition.

T. UL 262 - Gate Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

U. UL 312 - Check Valves for Fire-Protection Service; Underwriters Laboratories Inc.; 2004.

V. Chapter 120-3-3 of the Rules of the Safety Fire Commissioner dated January 1st. 2020.

W. Georgia State Minimum Standard Building Code (International Building Code), 2018 Edition, with all Georgia State Amendments. NFPA Code, where more stringent, shall take precedence.

1.4 SUBMITTALS

A. Refer to Section 21 0510 - General Fire Suppression Requirements for submittal procedures and requirements.

B. Product Data: Provide manufacturers catalogue information. Indicate valve data and ratings.

C. Shop Drawings: Indicate pipe materials used, jointing methods, supports, floor and wall penetration seals. Indicate installation, layout, weights, mounting and support details, and piping connections.

1.5 QUALITY ASSURANCE

A. Fire Protection

1. The Contractor expressly warrants that the company performing the installation of the fire protection systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least 5 commercial or institutional buildings, each containing minimum of 10,000 ft2 of protected area or greater.

2. The Contractor further warrants that the aforesaid subcontractor has trained personnel, instruments, tools, and equipment to perform the installation specified.

3. The Contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least the previous five consecutive years in the state of Georgia.

4. Provide a certificate of competency as issued by the Georgia State Fire Marshal's Office.

B. Conform to UL and FM requirements.

C. Valves: Bear UL and FM label or marking. Provide manufacturer's name and pressure rating marked on valve body.

D. Products Requiring Electrical Connection: Listed and classified as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Deliver and store valves in shipping containers, with labeling in place.

B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

PART 2 PRODUCTS

2.1 GENERAL SYSTEM AND PRODUCT REQUIREMENTS

A. Sprinkler Systems: Conform work to NFPA 13.

B. Welding Materials and Procedures: Conform to ASME Code.

C. Building is Light Hazard . Pipe sizes shall be hydraulically calculated based upon contractor's flow test performed prior to construction.

D. Provide hydraulic calculations over the most remote 1500 square feet providing density required for hazard as indicated in NFPA 13. Minimum discharge pressure shall be 7.0 PSI. Minimum residual pressure at city water main in the street shall be 20.0 PSI. Provide 10.0 PSI minimum safety margin in hydraulic calculations at design point. Design area reduction per NFPA 13 is allowed.

E. Basis of design: Contractor shall perform, or have performed, at the same time, a Fire Flow and Twenty Four Hour Static Test to assure flow equals or exceeds specified basis of design flow

rate prior to preparing shop drawings, installing system or performing calculations. Prepare calculations based on confirmed flow data or basis of design flow data, whichever is lowest. Flow test shall be performed in accordance with NFPA 13, NFPA 291, and Rules and Regulations of Safety Fire Commissioner, O.C.G.A. Chapter 120-3-3. Modify flow test pressures (static and residual), if pressure recorded in 24 hour test is lower than flow test pressures for minimum one hour duration, to lowest hour test pressure.

F. No pipe shall be routed above electrical panels and equipment as required by National Electrical Code, on control side or beneath suspended mechanical equipment except where specifically required by Code, in which case, provisions shall be made for service access and removal.

G. Where available, piping to sprinklers in all electrical and IT rooms, shall enter over interior doors.

H. Inspectors test connection(s) shall discharge to the outside of the building in location(s) acceptable to Design Professional.

I. Inside auxiliary drains, if needed, shall discharge in location(s) acceptable to the Design Professional. Drain and test connection piping, if in finished space, shall be installed concealed.

2.2 ABOVE GROUND WET SYSTEM PIPING

A. Steel Pipe: ASTM A 795 Schedule 10 or ASTM A 53 Schedule 40, black. Piping 2" and smaller shall be threaded. Piping 2 1/2" and larger shall be grooved with rigid couplings.

1. Malleable Iron Fittings: ASME B16.3, threaded fittings and ASTM A 47/A 47M.

2. Mechanical Grooved Couplings: Rigid ductile iron housing clamps to engage and lock, "C" shaped elastomeric sealing gasket, steel bolts, nuts, and washers; galvanized for galvanized pipe. Reducing couplings and flanges are NOT allowed.

2.3 PIPE HANGERS AND SUPPORTS

A. Hangers for Pipe Sizes 1/2 to 6 inch: Carbon steel, adjustable swivel ring.

B. Hangers for Pipe Sizes 8-inches and Over: Carbon steel, adjustable, clevis.

C. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

D. Vertical Support: Steel riser clamp.

E. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

F. Provide support for any vertical pipe 36" in length or greater except armovers. Provide supports 12'-0" O.C. maximum or at floor levels.

G. Threaded rods shall NOT be bent. Bending is permitted only in unthreaded sections of hanger rods. Bending shall occur as close to the hanger as possible. Provide a swivel assembly if required.

H. Hangers when Pressure exceeds 100psi: Provide surge clips or extend threaded rod to secure sprinkler pipe to hanger for the last hanger closest to the end sprinkler head in a pendent position to prevent upward movement, Refer to NFPA 13 17.4.3.4.4 and 17.4.3.5.2.

2.4 GATE VALVES

A. Up to and including 2 inches:

1. Manufacturers:

a. Nibco Scott; Product T-104-O

b. Hammond; Product 1B681

c. Stockham; Product B-133

d. Kennedy; Product Fig. 66

2. Bronze body, bronze trim, rising stem, handwheel, solid wedge or disc, threaded ends.

B. Over 2 inches:

1. Manufacturers:

a. Nibco Scott; Product F-607-OTS

b. Crane; Product 467

c. Hammond; Product 1R1154

d. Mueller; Product R-2361-6

e. Kennedy; Product Fig. 68

2. Iron body, bronze trim, rising stem pre-grooved for mounting tamper switch, handwheel, OS&Y, solid rubber covered bronze or cast iron wedge, flanged ends, 200 PSIG working pressure.

2.5 GLOBE VALVES

A. Bronze body, rubber disc, union bonnet, 174 W.W.P., threaded ends.

B. Up to and including 2 inches:

1. Manufacturers:

a. Nibco-Scott; Product KT-65.

b. Kennedy; Product 97SD.

c. United; Product 125S.

d. Fairbanks; Product 4691-3.

2.6 ANGLE VALVES

A. Bronze body, rubber disc, union bonnet, 174 non-shock cold water, threaded ends.

B. Up to and including 2 inches:

1. Manufacturers:

a. Nibco-Scott; Product T-301-W.

b. Kennedy; Product 985D.

c. United; Product 126S.

d. Fairbanks; Product 4691-3.

2.7 CHECK VALVES

A. Iron body, U.L. Listed- F.M. Approved, swing type, bronze trimmed, bronze seat and disc, flanged ends.

B. Manufacturers:

1. Crane; Product 375

2. Stockham; Product G-939

3. Mueller; Product A-2120-6BB

4. Kennedy; Product #126

2.8 BUTTERFLY VALVES 2" AND LARGER:

A. Indicating type, ductile iron body, wafer design type body, U.L. Listed - F.M. approved, with resilient seat, stainless steel stem and handwheel, grooved inlet and outlet, factory installed supervisory switches, 300psi Maximum working pressure.

B. Manufacturers:

1. Grinnell Series BFV-300.

2. Nibco GD-4863-8N.

3. United Water Products Series 2400-G

4. Tyco BFV-300

5. Victaulic 705 Series

PART 3 EXECUTION

3.1 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and foreign material, from inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

D. Storage: All piping shall be stored above ground and protected to prevent dirt and debris from entering pipe.

3.2 INSTALLATION

A. Install sprinkler system and service main piping, hangers, and supports in accordance with NFPA 13 and these specifications.

B. Route piping in orderly manner, plumb and parallel to building structure. Maintain gradient.

C. Install piping to conserve building space, to not interfere with use of space and other work.

D. Group piping whenever practical at common elevations.

E. All piping shall be installed above ceilings in a concealed manner except where no ceilings are present

F. Sleeve pipes passing through partitions, walls, and floors.

G. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

H. Reducing Tees: Weld-on threaded outlet tees and Coupolet-300 by Bonney Forge Division of Energy Products Group, Central Sprink 701, "TEE-LET" 300 by Merit Manufacturing Corp., NAP300 by North Alabama Pipe Corp., F400 by Grinnell Corp. may be used for side outlet reducing tees more than two pipe sizes smaller than main. Discs shall be retrieved and connected to pipe at point of cutting. Cutting shall comply with NFPA 13, Chapter 6.5.2.4.8.

I. Couplings may be used on gridded systems at only one end of each gridded branch line or on 2 1/2" or larger riser nipple to 2" or smaller branch line to facilitate connection provided that the coupling is connected to piping by a cut groove. Rolled grooves are not acceptable.

J. Pipe Hangers and Supports:

1. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

2. Place hangers within 12 inches of each horizontal elbow.

3. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

4. Support vertical piping at every floor. Support riser piping independently of connected horizontal piping.

5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

6. Hangers when pressure exceeds 100psi:

   a. Provide surge clips or extend threaded rod to prevent upward movement on the end sprinkler head, Refer to NFPA 13 Figure A.9.2.3.4.4.

   b. The unsupported armover length and unsupported branchline length shall not exceed 12” for end sprinklers in the pendent position.

K. Slope piping and arrange systems to drain at low points. Use eccentric reducers to maintain top of pipe level.

L. Prepare pipe, fittings, supports, and accessories for finish painting. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welding. Refer to Section 09 9000.

M. Do not penetrate building structural members unless indicated.

N. Provide sleeves when penetrating floors and walls. Seal pipe and sleeve penetrations to achieve fire resistance equivalent to fire separation required.

O. Die cut threaded joints with full cut standard taper pipe threads with red lead and linseed oil or other non-toxic joint compound applied to male threads only.

P. Install valves with stems upright or horizontal, not inverted. Remove protective coatings prior to installation.

Q. Provide gate valves for shut-off or isolating service. No valve shall be installed with the centerline, if horizontal, or wheel, if vertical, more than 9'-0" AFF.

R. Provide drain valves at main shut-off valves, low points of piping and apparatus. Route drains to interior mop basins or exterior of building in locations acceptable to Design Professional.

3.3 CLEANING AND PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to the Final Observation.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. All dents and sags in equipment casing shall be straightened.

F. All equipment, pipe, pipe fittings and appurtenances shall be free of rust and stains prior to substantial completion.

3.4 FINISHING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment and piping, in utility areas in colors according to the color coding scheme indicated.

C. Re-install electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all exposed pipes, unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

G. Paint all exposed un-insulated ferrous materials.

END OF SECTION

SECTION 21 1200 - FIRE-SUPPRESSION STANDPIPES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fire valve cabinets.

B. Valves.

1.2 RELATED REQUIREMENTS

A. Section 21 0510 - General Fire Suppression Requirements.

B. Section 21 1300 - Fire Suppression Piping.

1.3 REFERENCE STANDARDS

A. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2019.

B. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems, 2017.

C. NFPA 101 - Code for Safety to Life from Fire in Buildings and Structures; 2018.

D. Georgia State Minimum Standard Fire Prevention Code, 2018 Edition, with all Georgia State Amendments.

E. Chapter 120-3-3 of the Rules of the Safety Fire Commissioner dated January 1, 2020.

F. Georgia State Minimum Standard Building Code (International Building Code), 2018 Edition, with all Georgia State Amendments. NFPA Code, where more stringent, shall take precedence.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog sheet for equipment indicating rough-in size, finish, and accessories.

C. Shop Drawings: Indicate supports, components, accessories, and sizes.

1. Submit shop drawings and product data to Fire Marshal for approval and to the Design Professional for review. Submit to the Design Professional prior to submitting to the Fire Marshal. Submit proof of approval to Design Professional. Install no piping until receipt of approved shop drawings from the State Fire Marshal.

2. Submit proof of approval to the Design Professional.

D. Project Record Documents: Record actual locations of components.

E. Operation Data: Include appropriate manufacturer's data.

F. Maintenance Data: Include servicing requirements and test schedule.

G. Certificates: Provide certificate of compliance from authority having jurisdiction indicating approval of field acceptance tests.

1.5 QUALITY ASSURANCE

A. Perform Work in accordance with NFPA 14. Maintain one copy on site.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store products in shipping packaging until installation. Store piping off ground and cover to prevent dirt and debris from entering piping.

PART 2 PRODUCTS

2.1 FIRE VALVE CABINETS

A. Manufacturer: Potter Roemer ; Model 1810-FS.

1. Larsens

2. Elkhart

3. Croker

B. Cabinet:

1. Style: Recessed mounted.

2. Recessed Box: 20 gage, thick steel, prepared for pipe and accessory rough-in.

3. Door: 22 gage, Hinged Flush solid metal with positive latch device.

4. Finish: Prime coated.

2.2 VALVES

A. Hose Connection Valve: Angle type; brass finish; 2-1/2 inch size, thread to match fire department hardware, 300 psi working pressure, with threaded cap and chain of same material and finish; refer to Section 21 0500.

B. Pressure Reducing Valve: Angle type; brass finish with inner hydraulic controls; 1-1/2 inch size, thread to match fire department hardware, 400 psi inlet pressure, with threaded cap and chain of same material and finish; refer to Section 21 0500.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NFPA 14.

C. Locate and secure cabinets plumb and level. Establish top of cabinet (inside horizontal) surface 66 inches above finished floor.

D. Locate hose station valve in cabinet at 60 inches above finished floor.

E. Connect standpipe system to water source ahead of domestic water connection.

F. Where static pressure exceeds 175 psi but is less than 350 psi at any fire valve cabinet, provide pressure reducing valve on hose connection valve to prevent pressure from exceeding 175 psi.

G. Provide two way fire department outlet connection on roof.

H. Flush entire system of foreign matter.

3.2 FIELD QUALITY CONTROL

A. Perform field observation and testing in accordance with Section 01 4000.

B. Test entire system in accordance with NFPA 14.

C. Test shall be witnessed by Fire Marshal.

END OF SECTION

SECTION 21 1300 - FIRE-SUPPRESSION SPRINKLER SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wet Type Sprinkler System

B. System design, installation, and certification.

C. Fire department connections.

1.2 RELATED REQUIREMENTS

A. Section 28 3100 - Fire Alarm Systems.

B. Section 21 0510 - General Fire Suppression Requirements

C. Section 21 1100 - Fire Suppression Piping: Pipe, fittings, and valves.

D. Section 21 1200 - Fire-Suppression Standpipes.

E. Section 26 2717 - Equipment Wiring:

1.3 REFERENCE STANDARDS

A. FM (AG) - FM Approval Guide; current edition.

B. FM (AG) - FM Approval Guide; Factory Mutual Research Corporation; current edition.

C. NFPA 13 - Standard for the Installation of Sprinkler Systems; 2019.

D. NFPA 14 - Standard for the Installation of Standpipe and Hose Systems; National Fire Protection Association; 2019.

E. NFPA 25 - Standard for the Inspection, Testing, and Maintenance of Water-Based Fire Protection Systems; 2017.

F. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

1.4 SUBMITTALS

A. See Section 21 0510 - General Fire Suppression Requirements for submittal procedures.

B. Product Data: Provide data on sprinklers, valves, and specialties, including manufacturers catalog information. Submit performance ratings, rough-in details, weights, support requirements, and piping connections.

C. Shop Drawings:

1. Submit preliminary layout of finished ceiling areas indicating only sprinkler locations coordinated with ceiling installation.

2. Indicate hydraulic calculations, detailed pipe layout, hangers and supports, sprinklers, components, and accessories. Indicate system controls.

3. Submit shop drawings, product data, and hydraulic calculations to Fire Marshall for approval and to Architect for review. Submit to Architect prior to submitting to Fire Marshal. Submit proof of approval to the Design Professional. Install no piping until receipt of approved shop drawings from the State Fire Marshal.

D. Project Record Documents: Record actual locations of sprinklers and deviations of piping from drawings. Indicate drain and test locations. Provide two (2) CD and three (3) paper copies of as-built drawings. CD's shall be in Autocad release 14 or later or in microstation V8 format.

E. Manufacturer's Certificate: Certify that system has been tested and meets or exceeds specified requirements and code requirements. All certificates shall be signed by certificate holder.

F. Operation and Maintenance Data: Include components of system, servicing requirements, record drawings, inspection data, replacement part numbers and availability, and location and numbers of service depot.

G. Maintenance Materials: Furnish the following for the Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements for additional provisions.

2. Extra Sprinklers: Type and size matching those installed in quantity required by referenced NFPA design and installation standard.

3. Sprinkler Wrenches: For each sprinkler type.

1.5 QUALITY ASSURANCE

A. Maintain one copy of referenced design and installation standard on site.

B. Comply with FM (AG) requirements.

C. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.

D. Equipment and Components: Provide products that bear FM (AG) label or marking.

E. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store products in shipping containers and maintain in place until installation. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

B. Store piping off floor and out of elements. Provide cover for piping to prevent dirt and debris from entering piping. Piping and fittings shall be rust free when installed.

1.7 EXTRA MATERIALS

A. Provide extra sprinklers of type and size matching those installed, in quantity required by referenced NFPA design and installation standard.

B. Provide suitable wrenches for each sprinkler type.

C. Provide metal storage cabinet located at piping entrance to building.

PART 2 PRODUCTS

2.1 SPRINKLER SYSTEM

A. Sprinkler System: Provide coverage for entire building.

B. Occupancy is primarily: Light hazard; comply with NFPA 13.

C. Water Supply: Contractor shall perform or have performed an NFPA-13 water flow test and a 24 hour static pressure test. Adjust flow test to lowest pressure recorded by 24 hour test of one hour duration.

D. Interface system with building fire alarm system.

E. Provide fire department connections where indicated.

F. Storage Cabinet for Spare Sprinklers and Tools: Steel, located adjacent to alarm valve.

2.2 SPRINKLERS

A. Tyco and affiliates, Victaulic, Viking, Reliable, Globe, and Grinnell.

B. All sprinklers installed shall be by the same manufacturer.

C. Contractor shall select temperature ratings in accordance with NFPA 13.

D. Extended coverage sprinklers shall NOT be used except where shown on contract drawings.

E. Suspended Ceiling Type: Standard pendant type with matching flush push on two piece escutcheon plate.

1. Finish: Chrome plated.

2. Escutcheon Plate Finish: Chrome plated.

3. Fusible Link: Quick response Glass bulb type temperature rated for specific area hazard.

4. Orifice: 1/2".

F. Gypsum Board Ceiling Type: Concealed pendant type with matching push on escutcheon plate.

1. Cover Plate Finish: Painted, color Off white .

2. Fusible Link: Quick response Glass bulb type temperature rated for specific area hazard.

G. Exposed Area Type: Standard upright type .

1. Finish: Brass.

2. Fusible Link: Quick Response Glass bulb type temperature rated for specific area hazard.

3. Orifice: 1/2".

H. Sidewall Type: Standard horizontal sidewall type with matching flush push on two piece escutcheon plate .

1. Finish: Chrome plated.

2. Escutcheon Plate Finish: Chrome plated.

3. Fusible Link: Quick Response Glass bulb type temperature rated for specific area hazard.

4. Orifice: 1/2".

I. Institutional Type: Chrome Plated Tamper Proof Security Sprinkler Head.

1. Manufacturers:

a. Tyco Model; Raven Institutional Sprinkler. Coordinate color with architect.

b. Viking Model; VK410

c. Reliable Model; Institutional XL

J. Extended coverage sprinklers, except where shown on contract drawings, shall not be used.

2.3 PIPING SPECIALTIES

A. Water Flow Switch: Vane type switch for mounting horizontal or vertical, with two contacts; rated 10 amp at 125 volt AC and 2.5 amp at 24 volt DC. Notifier, Simplex, Potter, Grinnell.

B. Tamper Switch: Switch designed for installation on indicator valves with cased aluminum housing with red finish. Notifier, Simplex, Potter, Grinnell.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with referenced NFPA design and installation standard and these specifications.

B. Install sprinklers where shown on contract drawings. Sprinklers in gypsum board ceilings shall be in line with and centered between down lights unless shown otherwise.

C. Install equipment in accordance with manufacturer's instructions.

D. Each floor of multi-story buildings shall be zoned except as noted on contract drawings.

E. Place pipe runs to minimize obstruction to other work.

F. Place piping in concealed spaces above finished ceilings.

G. Center sprinklers in two directions in ceiling tile and provide piping offsets as required.

H. Apply masking tape or paper cover to ensure concealed sprinklers, cover plates, and sprinkler escutcheons do not receive field paint finish. Remove after painting. Replace painted sprinklers.

I. Flush entire piping system of foreign matter.

J. Hydrostatically test entire system.

K. Require test be witnessed by Fire Marshal, Design Professional or his designated representative.

L. All drain piping shall discharge to the outside 6" maximum above grade unless noted otherwise.

M. Where sprinklers are required under oval or round duct, the centerline of the sprinkler shall be under the centerline of the duct.

N. Where sprinklers are required under rectangular duct, the centerline of the sprinkler shall be minimum 6" under duct.

3.2 INTERFACE WITH OTHER PRODUCTS

A. Ensure required tamper and flow devices are installed and connected as required to fire alarm system including but not limited to floor control valves, alarm check valves, dry pipe valves, deluge valves, post indicator valves (PIV), backflow device valves, and fire and jockey pump valves.

3.3 SCHEDULES

A. System Hazard Areas:

1. Offices, Court Rooms, Corridors, Lobbies, Vestibules: Light Hazard.

2. Mechanical/ Electrical, closets, Storage Rooms, Work Rooms: Ordinary Hazard, Group 1.

SECTION 21 2200 - TOTAL FLOODING (CLEAN AGENT) EXTINGUISHING SYSTEM

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Total flooding extinguishing system for enclosed spaces.

B. Fire detection system.

C. Control and supervision systems.

D. Extinguishing agent, containers, distribution and discharge system.

E. System maintenance after closeout.

1.2 RELATED REQUIREMENTS

A. Section 08 7100 - Door Hardware: Release hardware for automatic closing doors.

B. Section 21 0510 - General Fire Suppression Requirements.

C. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

D. Section 28 3100 - Fire Alarm System

1.3 REFERENCE STANDARDS

A. ASME B31.1 - Power Piping; 2014.

B. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

C. ASME (BPVC-VIII, 1) - Boiler and Pressure Vessel Code, Section VIII, Division 1 - Rules for Construction of Pressure Vessels; The American Society of Mechanical Engineers; 2013.

D. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Welding, Brazing, and Fusing Qualifications; 2015.

E. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

F. ASTM A106/A106M - Standard Specification for Seamless Carbon Steel Pipe for High-Temperature Service; 2014.

G. ASTM A135/A135M - Standard Specification for Electric-Resistance-Welded Steel Pipe; 2009 (Reapproved 2014).

H. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

I. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2015.

J. FM P7825 - Approval Guide; Factory Mutual Research Corporation; current edition.

K. NEMA ICS 6 - Industrial Control and Systems: Enclosures; 1993 (R2011).

L. NFPA 72 - National Fire Alarm and Signaling Code; 2016.

M. NFPA 75 - Standard on the Protection of Electronic Computer/Data Processing Equipment; National Fire Protection Association; 2003.

N. NFPA 76 - Fire Protection of Telecommunication Facilities; National Fire Protection Association; 2005.

O. NFPA 2001 - Standard on Clean Agent Fire Extinguishing Systems; 2015.

P. Chapter 120-3-3 of the Rules of the Safety Fire Commissioner dated January 1st, 2020.

Q. UL (DIR) - Online Certifications Directory; current listings at database.ul.com.

R. UL 393 - Indicating Pressure Gauges for Fire-Protection Service; Current Edition, Including All Revisions.

S. UL 404 - Gauges, Indicating Pressure, for Compressed Gas Service; Current Edition, Including All Revisions.

T. UL 2166 - Standard for Halocarbon Clean Agent Extinguishing System Units; Underwriters Laboratories Inc.1999.

1.4 SUBMITTALS

A. See Section 21 0510 - General Fire Suppression Requirements, for submittal procedures.

B. Product Data: Provide for each piece of equipment comprising the system including detectors, release devices, discharge nozzles, manual controls, alarm devices, annunciators, extinguishing agent containers, manifolds, and control panel.

C. Shop Drawings: Indicate detailed layout of system, including piping and location of each component. Include relief openings, control diagrams, wiring diagrams, and written sequence of operation. Provide maximum leakage area for 10 minute hold for each room.

D. Design Data: Include calculations that verify system pressures, nozzle flow rate, orifice code numbers, piping pressure losses, component flow data, and pipe sizes.

E. Certificates: Certify that products meet or exceed specified requirements.

1. Manufacturer: Certify that system meets or exceeds specified requirements.

2. Welders: Submit certificate indicating compliance with ASME BPVC-IX and AWS D1.1/D1.1M.

F. Manufacturer's Instructions: Include recommended equipment installation and system components.

G. Maintenance Contract; 1 year from the date of Material Completion. Coordinate with owner for preferred maintenance vendor.

H. Project Record Documents: Record actual locations of components and equipment, equipment identification markings, conduit and piping routing details, and agent container positions.

I. Operation and Maintenance Data:

1. Include electrical schematic written description of system design, drawings illustrating control logic and equipment locations, and technical brochures describing equipment.

2. Include list of recommended spare parts.

3. Include checklists and procedures for emergency situations, troubleshooting techniques, abort functions, system control panel operation, trouble procedures, and safety requirements.

J. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. SYSTEM

1. Conform to NFPA 2001 and these specifications for system design, fabrication, and installation.

2. Welding Materials and Procedures: Conform to ASME BPVC-IX.

B. Fire Protection Subcontractor

The Contractor expressly warrants that the company performing the installation of the Clean Agent fire protection systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least 5 commercial or institutional buildings, each containing minimum of 10,000 ft3 of protected area or greater.

1. The Contractor further warrants that the aforesaid subcontractor has trained personnel, instruments, tools, and equipment to perform the installation specified.

2. The Contractor also warrants that the aforesaid installer has been in business performing services of the nature specified herein for at least the previous five consecutive years in the state of Georgia.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Deliver and store equipment in shipping containers with labeling in place. Deliver fire extinguishing agent in approved containers.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. Provide two year system warranty for complete replacement fire extinguishing agent.

PART 2 PRODUCTS

2.1 FIRE SUPPRESSION SYSTEM

A. Fire Suppression System: Complete fire detection and suppression system that totally floods protected area with fire extinguishing agent to extinguish fire.

1. Locate extinguishing agent supply in the locations designated on the drawings..

2. Locate manual release stations at each exit from protected area.

3. Locate abort stations at each exit from protected area.

4. Provide all manufactured system components from a single source and by a single manufacturer.

5. Provide components listed and labeled by Underwriters Laboratories Inc. for the type of system required and for use with the other components of the system.

B. Design Criteria: Provide total flooding of fire extinguishing agent at manufacturer's recommended concentration by volume, in maximum discharge time of 10 seconds, for period of 10 minutes and with 10 percent allowance for room leakage.

1. Direct discharge parallel to ceiling; use 360 degree pattern nozzles except where obstructions would make 360 distribution inefficient. 180 degree nozzles are acceptable.

2. Provide sufficient amount of fire extinguishing agent. Consider the following when computing volume:

a. Volume of protected area.

b. Specific volume of fire extinguishing agent.

c. Additional quantities of fire extinguishing agent required to compensate for openings, pipe losses.

d. Other special conditions affecting extinguishing agent concentration.

2.2 PIPE AND PIPING SPECIALTIES

A. Cast Iron or Steel Pipe: Pipe conforming to ASTM A 120, Specification for Pipe, Steel, Black and Hot Dipped Zinc Coated, Welded and Seamless for Ordinary Uses, or nonmetallic pipe shall NOT be used.

B. Steel Pipe: ASTM A53/A53M or ASTM A106/A106M Schedule 40, or ASTM A135/A135M Schedule 10, galvanized as specified in ASTM A53/A53M.

1. Fittings: ASME B16.3 malleable iron class 300 for sizes 2 inch and smaller, or ASTM A234/A234M, wrought steel welding type fittings.

2. Joints: Threaded, AWS D1.1/D1.1M welded, or grooved and shouldered pipe end couplings.

C. Pipe Hangers: ASME B31.1, UL approved for sprinkler systems, split clamp up to 2-1/2 inch size, riser clamps over 2-1/2 inch size, adequate to offset discharge thrust.

D. Escutcheons: Chrome plated pressed or stamped brass, one-piece or split pattern, minimum 2 inches larger than opening.

E. Gages:

1. ASME B40.100, UL 393, or UL 404 3-1/2 inch diameter cast aluminum case, phosphor bronze bourdon tube, rotary brass movement, brass socket, front re-calibration adjustment, black figures on white background, 1 percent mid-scale accuracy, scale calibrated in psi.

2.3 EXTINGUISHING AGENT CONTAINERS

A. Containers:

1. Where multiple, replaceable containers are used, provide only containers of the same size and holding the same amount of extinguishing agent.

B. Contents: Fill with required fire extinguishing agent.

C. Identification: Permanent plate or marking, specifying agent, tare and gross weight, pounds of fire extinguishing agent, and pressurization level; installed so plate or marking is visible and readable.

D. Safety Release: Equip with frangible disc safety device.

E. Valves: Heavy duty forged brass, with safety pressure relief device, manual control, discharge valve, and pressure gage.

F. Actuator: Resettable electric or pneumatic with pressurized nitrogen cartridge. Explosive devices are NOT permitted.

G. Manifold: Provide for systems with more than one container, with rack to secure each and check valves between each discharge and manifold.

H. Wall Bracket: Manufacturer's standard; UL listed, welded steel construction, modular design with saddle bottom and front bracket.

I. Cylinders of 200 lbs. or greater shall have liquid level indicator to provide reliable method of determining the agent weight with the storage container during normal servicing. Weighing of cylinder is not acceptable.

2.4 MANUAL STATIONS

A. Manual Release Station: Semi-flush housing fitted with double action control fitted with "push in" tab and "pull down" lever that locks in position after releasing spring-loaded contact switch, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.

1. Activate all audible and visual alarms.

2. Override any abort station or time delay function.

3. Activate all release and shutdown functions normally triggered by detectors or alarm system.

4. Locate engraved label adjacent to each manual release station indicating area protected and that actuation will cause discharge of fire extinguishing agent.

B. Manual System Abort Switch: Stainless steel plate with momentary contact push button, countdown timer, magnetic door holders manual release, for mounting on electrical outlet box; addressable using manufacturer's standard monitor module.

1. Locate engraved label adjacent to each manual abort station, indicating area protected and that actuation will prevent discharge of fire extinguishing agent after automatic system is activated.

2.5 DETECTORS

A. Ionization Smoke Detectors: UL listed, NFPA 72, adjustable sensitivity, operating on ionization principle, activated by combustion products, plug-in, twist-lock unit easily removed from base.

1. Ionization chambers: Dual, one for fire detection and second for reference, stabilizing detector for changes in temperature, humidity, and pressure.

2. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire, 24 volts. On alarm, unit shall lock and be reset at control panel.

3. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.

4. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

B. Photoelectric Smoke Detectors: UL listed, NFPA 72, adjustable sensitivity, with LED light source including photocell, activated by smoke, plug-in, twist-lock unit easily removed from base.

1. Amplifier-Switching Circuit and Indicator Lamp: Solid state, two-wire operating on detector line voltage. On alarm, unit shall lock and be reset at control panel.

2. Adjustment: Manual for normal or high sensitivity, with sensitivity setting visible and requiring no special tools.

3. Base Assembly: Twist-lock type with screw terminals, lamp to indicate alarm, security base lock, and relay contactor.

2.6 DISCHARGE NOZZLES

A. Nozzles: UL listed; orifice size providing required rates of discharge and coverage and to distribute extinguishing agent uniformly throughout protected area.

B. Construction: Two-piece chrome plated brass or aluminum nozzle with textured finish with female pipe thread integral on body; one-piece deflector plate.

C. Identification: Permanently mark nozzles to show manufacturer, type and equivalent single orifice diameter.

2.7 CONTROLS AND CONTROL PANEL

A. Controls: Combination type approved as both alarm and releasing device, with solid state internal circuitry enclosed in NEMA ICS 6, Type 1 cabinet.

B. Provide supervision to NFPA 72, Class A of following circuits for wire break or ground faults:

1. Zone detection loops.

2. Remote manual discharge stations.

3. Suppression system solenoid valves.

4. Power supply and circuit wiring and fuse.

5. Battery interconnecting wires and fuse.

6. Alarm in abort mode.

C. Conceal control switches and indicators, with exception of Power On, Master Trouble, Supervisory Trouble, Circuit 1 Alarm, Circuit 2 Alarm and Release Indicators.

D. Equip panel with following standard features:

1. Visual and audible annunciation of trouble or alarm signals.
2. Panel reset switch.
3. Trouble alarm silence switch with ring back feature.
4. Single zone detection: cross zone.
5. Battery test meter and switch.
6. Manual discharge switch.
7. Deadman abort switch.
8. Programmable timers for pre-discharge and discharge, 0 to 60 second cycle.
9. Isolated relay contactors for external alarm or equipment and ventilation shutdown.
10. Relay contactors for general trouble signal.
11. Relay contactor activated by detector zone board in alarm or trouble mode.

E. Annunciation: Provide the following annunciation:

1. Power On: Green.
2. System Trouble: Amber.
3. Battery Trouble: Amber.
4. Circuit 1 Trouble: Amber.
5. Circuit 2 Trouble: Amber.
6. Ground Fault: Amber.
7. Release trouble: Amber.
8. Alarm Circuit 1: Red.
9. Alarm Circuit 2: Red.
10. Agent Release: Red.
11. Alarm Silence: Amber.
12. Battery Polarity: Amber.
13. Abort Trouble: Amber.
14. Alarm Output Trouble: Amber.

15. Supervisory Trouble: Amber.

F. Batteries: Provide nickel cadmium batteries and charger for continuous operation of detection, alarm, actuation and supervision functions for 24 hours. Provide automatic battery switch-over upon failure of primary power supply.

2.8 MISCELLANEOUS EQUIPMENT

A. Mounting Height: Mount miscellaneous equipment listed above 80 inches above floor or 72 inches, whichever is lower.

B. Alarm Bells: 24 volts, with supervision of circuit wiring, of modular design, red baked enamel finish, with minimum sound level of 84 dba at 10 feet, for mounting on 4 inch electrical outlet box.

C. Alarm Horns: 24 volts, with supervision of circuit wiring, with minimum sound level of 90 dba at 10 feet, for mounting on 4 inch electrical outlet box.

D. Strobe Beacon: Manufacturer's standard design, 24 volts, with system identification on strobe lens.

2.9 OPERATING SEQUENCE

A. Actuation of one detector in either zone circuit:

1. Illuminate zone indicator.

2. Energize alarm bell.

3. Shut down air-conditioning system and close dampers.

4. Close doors to area.

5. Signal building fire alarm system.

B. Actuation of second detector on second zone circuit:

1. Illuminate zone indicator.

2. Energize alarm horn.

3. Shut down power to protected equipment.

4. Actuate time delay for up to 30 seconds.

5. Release extinguishing agent into protected area.

6. If abort switch is engaged, delay release.

7. Upon abort switch disengagement release extinguishing agent unless system cleared and reset.

C. Discharge of Extinguishing Agent:

1. Sounds alarm bells and horns.

2. Operates strobes.

D. Temperature Detection:

1. Lower Temperature: Illuminate indicator and energize bell.

2. Higher Temperature: Shut down power to protected equipment.

E. High Temperature Detection: Close circuit to sprinkler pre-action valve.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that enclosing walls are continuous above ceilings and below raised floors to enable required concentration to be built up and maintained for required time to ensure fire is extinguished.

3.2 INSTALLATION

A. Install in accordance with standards referenced in PART 2 of this section (the referenced standards) and NFPA 2001.

B. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe. Remove scale and dirt on inside and outside before assembly. Blow out pipe before nozzles or discharge devices are installed.

C. Route piping in orderly manner, concealed, plumb and parallel to building structure, and maintain gradient. Install piping to conserve building space, and not interfere with use of space and other work.

D. Securely support piping in accordance with ASME B31.1 with allowance for fire extinguishing agent thrust forces, and thermal expansion and contraction.

E. Use grooved mechanical couplings and fasteners only in accessible locations. Roll groove piping only.

F. Install unions downstream of valves and at equipment or apparatus connections.

G. Identify in accordance with requirements of referenced standard.

H. In rooms with suspended ceiling tiles, clip or retain tiles within 4 foot radius of the nozzles to prevent lifting during discharge.

I. Install wiring in accordance with Section {\id\#877} requirements.

J. Make final connections between equipment and system wiring under direct supervision of factory trained representative of manufacturer.

K. Install engraved plastic instruction plate, detailing emergency procedures, at control panel and at each manual discharge and abort switch location. At control panel identify control logic units, contacts, and major circuits with permanent nameplates.

L. At hazard area walls pack space between pipe, pipe sleeve or surface penetration with mineral fiber with elastomer calk to depth of 1/2 inch. Provide escutcheons where exposed piping passes through walls, floors, and ceilings. Seal pipe penetrations of fire separations. Refer to Section 07 8400.

M. Locate discharge nozzle approximately 6 inches above or below ceiling and 6 inches below raised floors. Avoid interference with other piping and equipment.

N. Locate remote manual releases at one or more doors to protect area where indicated. Locate deadman abort switch adjacent.

O. Locate strobe units at all points of entrance to protected area.

P. Locate abort station at all points of exit from protected area.

3.3 INTERFACE WITH OTHER PRODUCTS

A. Provide interlock with automatic closing door releases. Refer to Section 08 7100.

B. Provide interlock with motorized dampers. Refer to Section 23 0913.

C. Provide signal to building fire alarm system. Refer to Section 28 3100.

3.4 FIELD QUALITY CONTROL

A. Perform field inspection and testing in accordance with NFPA 2001.

B. Test distribution piping and valving to pressure not exceeding standard operating pressures.

C. Upon completion of installation provide final checkout inspection by factory trained representative of manufacturer to ascertain proper system operation. Leave system in a fully commissioned and automatic readiness state with circuitry energized and supervised.

D. Test circuits including automatic discharge, manual discharge, equipment shut-down, alarm devices, and storage container pressure. Test supervision of each circuit.

E. Check each ionization detector with a sensitivity meter, adjust. Record sensitivity, and include record in test report.

F. Submit original copies of tests, indicating that factory trained technical representatives of the manufacturer have inspected and tested systems and are satisfied with methods of installation, connections and operation.

G. Pressure test entire enclosure with test fan, pressurizing protected area both under positive and negative conditions. Confirm that leakage is within system design allowance for a minimum of ten (10) minutes to the top of the highest piece of equipment to be protected or ceiling if air movement cannot be eliminated.

3.5 DEMONSTRATION AND INSTRUCTIONS

A. Demonstrate that components, except discharge assemblies, are functioning properly and in conjunction with controls system.

B. Submit integrated step-by-step test procedure for approval 30 days prior to start of demonstration.

1. Arrange meeting prior to demonstration with representatives of the Owner, the Owner's underwriter, and the installer.

2. Perform visual inspection and overall review of system installed.

3. Place minimum of three UL-listed recording analyzers in space. Provide certification that testing devices have been checked by recognized testing authority within two weeks of date of demonstration.

3.6 MAINTENANCE

A. See Section 01 7000 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

B. Provide inspections and maintenance performed by competent personnel in the employ of the system installer.

C. Conduct inspections at 6 months and 12 months from Date of Substantial Completion to verify proper operation of system, check agent container weight and pressure, and a thorough check of controls, detection and alarm systems.

D. Remedy of all deficiencies shall be included at no extra cost to the Owner except for replacement of agent due to discharge under normal use or damage due to abuse.

E. Submit documents certifying satisfactory system conditions. Include manufacturer's certificate of acceptance of inspector's qualifications.

END OF SECTION

SECTION 22 0510 - GENERAL PLUMBING REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Assurance Requirements and Installer Qualifications.

C. Submittal Procedures Supplementing Section 01 3000.

D. Operating and Maintenance Manuals

E. Execution Requirements common to Division 22 systems

F. Pipe Sleeves within building

G. Pipe Sleeves in footings and foundations

H. Piping Pressure Tests.

I. Equipment bases and housekeeping pads

J. Training Requirements

K. Cleaning Requirements.

L. Finishing Requirements

1.2 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Section 01 7700 - Closeout Procedures, for additional submittal and warranty requirements.

C. Section 03 3000 - Cast-in-Place Concrete.

D. Section 07 8400 - Firestopping.

E. Section 07 9200 - Joint Sealants

F. Section 09 9100 - Painting.

1.3 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Design Professional shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe system.

1.4 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the City Building Official.

D. Permits: Obtain all permits, paying all fees in connection therewith. At completion, have work inspected by proper authorities and furnish the Design Professional for the Owner an inspection certificate showing approval of installation.

E. Plumbing: Conform to the Georgia State Minimum Standard Plumbing Code (International Plumbing Code), 2018 Edition, with (2020), (2022), (2023) & (2024) Georgia State Amendments.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2018 Edition, with all Georgia State Amendments, for all work involving cutting and welding.

G. Gas: Conform to the Georgia State Minimum Standard Gas Code (International Fuel Gas Code), 2018 Edition, with (2020) & (2022) Georgia State Amendments.

H. Energy: Conform to the Georgia State Energy Code for Buildings (International Energy Conservation Code), 2015 Edition, with (2020), (2022) & (2023) Georgia State Amendments.

I. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 1st, 2020".

J. All Work: Conform to State of Georgia Chapter 120-3-20 "Access To and Use of Public Facilities by Handicapped Persons" and 2010 ADA Standards for Accessible Design.

K. All Work: Conform to State of Georgia Chapter 120-3-20 "Access To and Use of Public Facilities by Handicapped Persons" and 2010 ADA Standards for Accessible Design.

L. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2023.

M. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2018 Edition with (2020), (2022), (2024) & (2025) Georgia State Amendments.

1.5 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.6 SUBMITTALS

A. Refer to Section 01 3000 - Administrative Requirements, for submittal procedures.

B. Supplementing Division 1 requirements; the Contractor shall:

1. Review the submittal data and check to ensure compliance with specifications prior to submitting.

a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Design Professional are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.

b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal and letter form to the Design Professional any and all deviations from the Contract Documents.

c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.

d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.

2. Assemble the submittal data in compete sets in hard back three-ring binders, separate binders, and bound with numbered index sheets and tabs. All submittal data shall be submitted at one time unless unavailable data would delay project progress. Data shall include capacities, complete installation instructions, dimensional data and electrical data, BHP, motor HP, operating weights and load distribution at mounting points. Any submittals sent in pieces or not secured in a three ring binder will be marked not reviewed and will be returned to the contractor.

3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.

4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

5. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the

quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment.

6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

7. Deliver submittals to the Design Professional at the business address.

8. Electronic Delivery of Submittals:

   a. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Construction Manager will be provided with a project folder and password.

   b. Prepare the submittals as described above in Sections 1.7.A.1-7. Provide one pdf file for each specification section including all submittal data for that specification section. Provide labels identifying each piece of equipment, piping, or accessory to match the listed item in the specification. Take steps to reduce submittal file size.

   c. Do not scan in color or high resolution unless needed for clarity.

   d. Ensure any reproductions are legible.

   e. Send an email to submittal@nbpengineers.com with a copy to the Plumbing Design Professional and the Architectural Design Professional (if applicable) identified during the preconstruction phase.

   f. Provide a submittal index and identify the submittal in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx. Addition to Administrative Building - Section 22 0519 - Meters and Gages for Plumbing Piping.

   g. Each pdf should include bookmarks to each product, and specification section to easily navigate the pdf file.

   h. Ensure the submittal posted to the FTP site has the same identification.

   i. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.

C. Product Data:

1. Provide data specific to the Product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.

2. Manufacturer's standard drawings shall be modified by deletions or additions to show only items applicable to this project.

1.7 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for review a minimum of two months prior to the request for Material Completion.

B. Digital delivery of Operating and Maintenance Manuals:

1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.

2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.

3. Do not scan in color or high resolution unless required for clarity.

4. Ensure any reproductions are legible.

5. Send an email to submittal@nbpengineers.com with a copy to the Plumbing Design Professional and the Architectural Design Professional (if applicable) identified during the preconstruction phase.

6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.

7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.

8. Ensure the manuals posted to the FTP site has the same identification.

9. The O&M Pdf should contain bookmarks to each section of the manual, and bookmarks to each product.

10. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:

1. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.

2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.

3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.

4. Copies of as-built shop drawings showing layouts and construction details.

1.8 QUALITY ASSURANCE

A. Plumbing Installer Qualifications:

1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.

2. Refer to the individual sections within this division for additional installer qualification requirements.

3. The Contractor expressly warrants that the company performing the installation of the plumbing systems has demonstrated proficiency in the installation and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing water heating systems, pumping systems(i.e. hot water recirculation, sump pumps, or pressure booster pumps), and a minimum of 10 plumbing fixtures.

4. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least three(3) years.

1.9 PRODUCT DELIVERY, STORAGE, AND PROTECTION

A. Accept all products on site in factory-fabricated protective containers. Inspect for damage.

B. Store products in a clean dry place and protect from weather and construction traffic.

C. Handle products carefully to avoid damage to components, enclosures, and finish.

D. After placement, protect products from damage during construction, by all trade contractors.

E. Protect equipment nameplates and labels from damage, being painted, scaring, etc.

1.10 WARRANTY

A. Refer to Section 01 7700 - Closeout Procedure, for additional warranty requirements.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

PART 2 PRODUCTS-NOT USED

PART 3 EXECUTION

3.1 EXAMINATION

A. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Design Professional for clarification in the event of conflict.

B. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment and pipes. They are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:

1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.

2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.

3. All equipment requiring service shall be made accessible. Coordinate piping installation to avoid conflict with other trades.

C. Where new work is specified tying into old work and materials are different from existing, the contractor shall request a clarification from the Design Professional prior to performing the work.

D. Where sanitary drainage systems or storm drainage systems are to be reused in existing buildings. The contractor shall camera all existing piping below slab that is to be reused to verify the piping is the correct size, the piping is sloped in the correct direction, the pipe is not broken or damaged, and the piping is free of obstructions. The contractor shall notify the design professional of any deficiencies prior to performing any work.

3.3 DEMOLITION

A. Drawings showing existing building conditions and utilities are based on casual field observation and existing record documents only.

1. Verify that construction and utility arrangements are as shown.

2. Report discrepancies to the Architect before disturbing existing installation.

3. Beginning of alterations work constitutes acceptance of existing conditions.

B. The demolition plans have been prepared to assist the contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. The

contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

C. All existing equipment and material removed from the facility shall be the property of the Contractor, unless otherwise noted, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

D. Where the Documents indicate an equipment item to be removed. Remove all associated material including hangers, supports, etc. Do not leave abandoned items.

E. Remove exposed and accessible piping, and other materials rendered useless due to changes or modifications. Cap outlets in piping. Repair piping insulation damaged during construction.

F. Remove concealed piping which is exposed by the removal of walls, partitions, etc., and reconnect and re-route as required to maintain system continuity.

G. Sleeves left open by removal of piping shall be cut flush with the finished slab or wall, filled with non-shrinking cement grout and/or fire rated foam flush with both sides of slab or wall to maintain slab or wall fire rating.

H. Material and equipment which has been removed shall not be used in the new work, except as noted.

I. Where existing piping and/or equipment is shown on the Drawings, its size and location shall be verified prior to performing any work relating to demolition. Notify Architect of any discrepancies.

J. Dispose of any material to be discarded in accordance with all laws and regulations.

K. Comply with all other applicable requirements of this Section and related Sections of the project manual.

3.4 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no pipes, vents, or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Provide equipment coupling guards shielding the perimeter and face of all new shafts and couplings. Provide openings opposite drive shafts to permit use of revolution counter.

E. Route piping to avoid skylights, translucent, and transparent ceilings.

F. Pipe Sleeves in Slabs, Masonry Walls and Partitions:

1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.

2. Omit sleeves on cast iron pipe through slabs on grade.

3. Provide sleeve seals where pipe passes thru building wall to a below grade location.

4. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab. Provide 4" high concrete curb around piping penetrating mechanical penthouse floor slabs.

5. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.

6. Omit sleeves in openings core drilled in masonry partitions.

7. Rated Drywall Partitions: Schedule 40 black steel pipe. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.

8. Non-Rated Drywall Partitions: Omit sleeves.

G. Pipe sleeves in footings and foundation walls:

1. Schedule 40 black steel pipe.

2. Water pipe, distribution piping, soil or waste pipe or building drain passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.

H. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400 - Through Penetration Firestop Systems.

I. Seal sleeves and openings in exterior walls vaportight or watertight as applicable. Refer to Section 07 9200 - Joint Sealants.

J. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" galvanized steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

K. Saw cut or core drill openings in existing work for the installation of the plumbing system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

L. Continuity of Building Services:

1. Conform to staging as described under Division 01.

2. Schedule work so existing building systems will not be interrupted when they are required for normal usage of the existing building.

3. Perform work to provide minimum inconvenience to the Owner and as approved by the Design Professional. No allowance will be made for lack of knowledge of existing conditions.

3.5 PIPING PRESSURE TESTS

A. General:

1. Provide 48 hours notification to the Design Professional in advance of any test.

2. Complete tests prior to insulating.

3. Leaks shall be repaired, defective materials replaced, and system shall be retested.

4. Strike all joints in copper and steel piping under a pressure test.

5. Conduct tests prior to connecting to equipment or isolate equipment from system.

6. No water pressure test shall be conducted in freezing weather where subject to freezing.

7. Test shall be maintained at conditions specified until approved but, in no event, for less than eight (8) hours minimum duration, unless otherwise noted.

8. Hydrostatic pressure tests shall maintain pressure without change, except that due to temperature change.

B. Domestic Water System: Hydrostatic test; 150 PSIG.

C. Soil, Waste and Vent System: Static test; 10 feet minimum head. Test system in its entirety or in sections. Plug all openings except highest opening above the roof. Water shall be kept in the system, or in the portion under test, for a minimum of one (1) hour. Inspect the system, or the portion under test, after one (1) hour, the system shall be tight at all points.

D. Multistory Buildings: Test tees shall be provided in soil, waste and storm drain piping to eliminate pressure testing of more than two floors at a time.

E. Natural Gas System: Pressure test; 50 PSIG air or inert gas; 3 hours minimum duration. Oxygen shall not be used.

F. Force Main Piping: Hydrostatic Test; 100 PSIG.

3.6 EQUIPMENT BASES and HOUSEKEEPING PADS

A. Provide housekeeping and equipment bases as shown or listed below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 2 inches from edges of equipment, unless otherwise noted.

D. Height:

1. Water Heater: 4-inches.

2. Concrete curb at all pipe penetrations of floors in mechanical rooms above grade: 4-inches or as shown on plans.

3. Housekeeping Pads for Other Equipment: 4-inches or as shown on plans.

E. Chamfer: 3/4-inch on edges and corners.

F. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.7 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of equipment to the Owner 's designated representative.

3.8 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instruct operating personnel designated by the Using Agency in operation and maintenance of system prior to request for final inspection. Provide signed statement certifying instructions have been received.

B. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Using Agency. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.

C. The Contractor shall develop not less than three (3) copies of the instructions with an index for easy retrieval of information.

3.9 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Material Completion.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. Clean and polish all equipment nameplates. All nameplate information shall be legible.

F. All dents and sags in equipment casings shall be straightened.

G. All insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Material Completion.

3.10 FINISHING PLUMBING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

D. Paint all exposed pipes , unless otherwise indicated.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

G. Paint all exposed un-insulated ferrous metals.

END OF SECTION

SECTION 22 0519 - METERS AND GAUGES FOR PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pressure gauges and pressure gauge tappings.

B. Thermometers and thermometer supports.

C. Test plugs.

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements.

B. Section 22 0719 - Plumbing Piping Insulation.

1.3 REFERENCE STANDARDS

A. ASME B40.100 - Pressure Gauges and Gauge Attachments; 2013.

B. ASTM E1 - Standard Specification for ASTM Liquid-in-Glass Thermometers; 2014.

C. ASTM E77 - Standard Test Method for Inspection and Verification of Thermometers; 2014.

D. AWWA C701 - Cold-Water Meters -- Turbine Type, for Customer Service; 2012.

1.4 SUBMITTALS

A. Refer to Section - 22 0510 General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide list that indicates use, operating range, total range and location for manufactured components.

PART 2 PRODUCTS

2.1 PRESSURE GAUGES

A. Manufacturer: Trerice Model 500X.

B. Other acceptable manufacturers offering equivalent products: Duro 102, Marsh 103, Palmer 40SPDLH, Weksler BM1, Weiss AG-1.

C. Gauge: ASME B40.1, UL 393 case, bourdon tube, rotary brass movement, brass socket, with front recalibration adjustment, black scale on white background and pulsation snubber.

1. Size: 4-1/2 inch diameter.

2. Mid-Scale Accuracy: One percent.

3. Scale: Psi.

2.2 PRESSURE GAUGE TAPPINGS

A. Ball Valve: 1/4 inch, 400 psig WOG, Bronze two piece body, standard port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip, threaded ends.

2.3 STEM TYPE THERMOMETERS

A. Manufacturers:

B. Manufacturer: Trerice Model AX9.

C. Other acceptable manufacturers offering equivalent products: Ashcroft 200-36E, Duro 7EZ3-6, Moeller 706AW, Palmer 9FLA, Weiss 7VS6, Weksler AA5.

D. Thermometers - Adjustable Angle: Red- or blue-appearing non-toxic liquid in glass; ASTM E 1; lens front tube, cast aluminum case with enamel finish, cast aluminum adjustable joint with positive locking device; adjustable 360 degrees in horizontal plane, 180 degrees in vertical plane.

1. Size: 7 inch scale.

2. Window: Clear Lexan.

3. Accuracy: 2 percent, per ASTM E 77.

4. Calibration: Degrees F.

2.4 THERMOMETER SUPPORTS

A. Socket: Brass or stainless steel separable sockets for thermometer stems. Provide cap and chain where not used to mount permanent instrument or control sensor. Provide lagging extension when mounted on insulated pipe.

2.5 TEST PLUGS

A. Manufacturer: FDI Model Super Seal.

B. Other acceptable manufacturers offering equivalent products: MG Piping Products Co., Sisco, Trerice, Texas Fairfax, Universal Lancaster.

C. Test Plug: 1/4 inch or 1/2 inch brass fitting and retained cap for receiving 1/8 inch outside diameter pressure or temperature probe with neoprene core for temperatures up to 200 degrees F. Provide extra-long shaft when mounted on insulated pipe.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install metering products in accordance with manufacturer's instructions for intended fluid type and service.

B. Install pressure tappings on piping where specified or shown on details. Provide ball valve to isolate each tapping connection to system. Extend nipples to allow clearance from insulation.

C. Install gauges and thermometers in locations where they are easily read from normal operating level. Install vertical to 45 degrees off vertical. Fill sockets with SAE 10W oil for conduction.

D. Adjust gauges and thermometers to final angle, clean windows and lenses, and calibrate to zero.

E. Locate test plugs adjacent to thermometers, temperature wells, pressure gauges, and where shown. Install in 1/2 inch pipe opening(minimum), with bushing.

F. Install test plugs vertical to horizontal. Do not install pointing down.

3.2 SCHEDULES

A. Stem Pipe Type Thermometers Scale Range:

1. Provide thermometers where shown on details and specified.

END OF SECTION

SECTION 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates

B. Tags

C. Pipe Markers

1.2 REFERENCE STANDARDS

A. ASME A13.1 - Scheme for the Identification of Piping System; The American Society of Mechanical Engineers; 2020.

B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2013.

1.3 SUBMITTALS

A. Refer to Section 22 0510- General Plumbing Requirements, for submittal procedures.

B. List: Submit list of wording, symbols, letter size, and color coding for plumbing identification.

C. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved letters.

B. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

C. Size:1/2 inch high letters unless otherwise noted.

D. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

2.2 TAGS

A. Manufacturers: Brimar, Kolbi, Seton.

B. Metal: Brass, 19 gauge 1-1/2 inch in diameter with smooth edges, blank, smooth edges, and corrosion-resistant ball chain. Up to three lines of text.

2.3 PIPE MARKERS

A. Manufacturers: Brimar, Seton Name Plate Co Setmark, Kolbi Industries Style A thru E(5 inch and smaller) else Style F thru H, Marking Services.

B. Pipe Markers for Indoor Use: Seton Setmark; media indicator with direction-of-flow arrows on calendered vinyl sheet; snap-around type for pipe sizes to 5-7/8 inches diameter, strap around type with nylon ties for pipe sizes 6 inches diameter and larger.

C. Flexible Marker: Factory fabricated, semi-rigid, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid conveyed.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive identification products.

3.2 INSTALLATION

A. Install flexible nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.

B. Install tags in clear view and align with axis of piping

C. Identify equipment such as pumps, water heaters, tanks, compressors and enclosed motor controllers with plastic nameplates.

D. Identify small devices, such as in-line pumps, with tags.

E. Where equipment is located above ceilings; Apply nameplate to ceiling grid for equipment located above accessible ceilings or to access panel for non-accessible ceilings.

F. Identify control panels and major control components outside panels with plastic nameplates.

G. Install Pipe Markers on all piping systems at the following Locations:

1. Mechanical Equipment Rooms:

   a. Within 18 inches of each valve.

   b. Within 36 inches of each 90 elbow, tee, connection to equipment or vessel and point where pipe exits room.

   c. At not over 20 feet intervals along all exposed piping.

2. Above Suspended Ceilings:

   a. Within 18 inches of each valve or valve assembly.

   b. At tees, identify both main and branch within 36 inches of tee.

   c. Within 36 inches of each 90 elbow.

   d. At not over 15 feet intervals along all concealed piping.

3. Piping Exposed in Rooms Other Than Mechanical Equipment Areas:

    a. Omit identification on piping, 1 inch exterior diameter or smaller(insulated or uninsulated) or exposed at connections to equipment or plumbing fixtures.

    b. With the above exception, identify at not less than one point each piping run visible in each room, with identification on not over 20 feet intervals.

END OF SECTION

SECTION 22 0719 - PLUMBING PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation

B. Jackets and accessories

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements

B. Section 22 0553- Identification For Plumbing Piping and Equipment

1.3 REFERENCE STANDARDS

A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2013.

B. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2015.

C. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2015.

D. ASTM D1056 - Standard Specification for Flexible Cellular Materials--Sponge or Expanded Rubber; 2014.

E. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2012.

F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

H. UL 910 - Standard for Test for Surface Burning Characteristics of Building Materials; Underwriters Laboratories Inc.; 2003.

I. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.5 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum three years of experience.

1.6 REGULATORY REQUIREMENTS

A. Conform to maximum flame spread/smoke developed rating of 25/50 in accordance with ASTM E 84.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.8 FIELD CONDITIONS

A. Maintain ambient conditions required by manufacturers of each product.

B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84, UL 723, ASTM E84, or UL 723.

2.2 GLASS FIBER (RIGID)

A. Manufacturers:

1. Knauf Insulation; Earthwool 1000° Pipe Insulation: www.knaufinsulation.us/en.

2. Johns Manville Corporation; Micro-Lok HP Ultra: www.jm.com.

3. Owens Corning Corp; SSLII with ASJ Max Fiberglas Pipe Insulation: www.owenscorning.com.

B. Insulation: ASTM C 547; semi-rigid, noncombustible, end grain adhered to jacket.

1. 'K' value: ASTM C355 , 0.24 at 100 degrees F (0.035 at 38 degrees C).

2. Maximum service temperature: 850 degrees F.

3. Moisture sorption by weight: Less than 5%.

C. Jacketing: ASTM C1136; Polymer or Polypropylene coated factory applied vapor barrier jacket with self-sealing lap and butt strips; moisture vapor transmission, when tested in accordance with ASTM E 96 Procedure A, of 0.01 perms max.

D. Vapor Barrier Lap Adhesive: Compatible with insulation.

2.3 GLASS FIBER, FLEXIBLE

A. Manufacturers: Certainteed, Knauf, Owens-Corning, JohnsManville.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.

1. 'K' value: 0.36 at 75 degrees F, when tested in accordance with ASTM C 518.

2. Maximum Service Temperature: 250 degrees F.

3. Maximum Water Vapor Sorption: 5.0 percent by weight.

4. Density: 3/4 lb./cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed stainless steel, 16 gage.

2.4 PHENOLIC

A. Manufacturers:

1. ITW; Model Trymer-Green

2. Dyplast DyTherm

B. Insulation Material: ASTM C 591, closed cell rigid molded foam, 2# density, minimum .

1. Dimension: Comply with requirements of ASTM C 585.

2. 'K' value: 0.19 at 75 degrees F, when tested in accordance with ASTM C 518.

3. Minimum Service Temperature: -70 degrees F.

4. Maximum Service Temperature: 248 degrees F.

5. Water Absorption: 0.5 percent by volume, maximum, when tested in accordance with ASTM D 2842..

6. Moisture Vapor Transmission: 1.0 perm in.

7. Connection: Waterproof vapor barrier adhesive.

2.5 JACKETS

A. ASJ (All Service Jacket): Polymer or Polyproylene coated factory applied vapor barrier jacket with self-sealing lap and butt strips; moisture vapor transmission, when tested in accordance with ASTM E 96 Procedure A, of 0.01 perms max. Jackets shall meet the requirements of ASTM C1136.

B. Glass Fabric Vapor Barrier Finish;

1. Cloth: Untreated 9 oz./sq. yd. weight.

2. Blanket: 1.0 lb./cu ft density.

3. Weave: 5x5.

4. Lagging Adhesive: Fire resistant compatible with insulation.

5. Finish: Vinyl emulsion type acrylic, compatible with insulation, grey color.

2.6 STAPLES, BANDS, AND WIRES

A. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

B. Wire shall be 18-gauge stainless steel.

2.7 ADHESIVES, COATINGS, SEALING COMPOUNDS AND PROTECTIVE FINISHES

A. Lagging Adhesive and Coating for Glass Cloth Jackets and Other Facings - MIL-A-3316 B, Class 1.

B. Lap Adhesive for Vapor Barrier Jacket - MIL-A-3316 B, Class 2.

C. Bonding Adhesives - for securing insulation to metal surfaces - MIL-A-3316 B, Class 2 for temperature up to 200 degree F.

D. Contact Type Adhesive - For installing flexible unicellular insulation - MIL-A-24179, Type II, Class 1.

E. Bedding Compound and Joint Sealers - MIL-B-19564A.

F. Coating Compound - Vapor Barrier Treatment - MIL-C-19565B, Type 1 or II.

G. Protective Finish Outside of Buildings - Coating Compound MIL-C-19565 B, Type I.

H. Manufacturers: Childers, Foster, Armstrong, Mon-Eco.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with North American Insulation Manufacturers Association (NAIMA) National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Fixture Supply Piping Exposed and in Cabinets: Do not insulate.

F. Domestic Cold Water Piping in Plumbing Chases and Concealed in Non-exterior Walls: Do not insulate.

G. Valves and fittings:

1. Insulate pipe and all valves and fittings including valve bonnets on domestic cold water, domestic hot water, horizontal storm drainage, and horizontal insulated waste piping. Leave only valve stems, open ends of wells and gauge cocks exposed.

2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with coating reinforced with glass cloth.

H. Insulation at Hangers: Hangers for condensate drain, horizontal storm drain, horizontal insulated waste piping, domestic water, and trapeze supports shall be outside of insulation with saddles as specified herein.

I. Saddles: Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping. Length and gauge of saddle shall be as follows:

1. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.

2. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.

3. 4 inch pipe size:16 Gauge saddle,16 inch long, minimum.

4. 6 inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

J. Insulated roof drain piping: Provide vapor barrier jackets, factory-applied or field-applied. Secure with either tape or self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Insulate fittings and joints. For exposed piping insulate fittings with molded insulation of like material and thickness as adjacent pipe and finish with fiberglass cloth in mastic.

K. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 22 0510.

L. Fiber Glass, Flexible:

1. Do not pull insulation tight around pipes.

2. Lap transverse joints 2 inch, minimum and secure with staples 18 inches on center.

3. Wrap insulation with Tie Wire 18 inches on center, maximum.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.4 SCHEDULES

A. Plumbing Systems:

1. Domestic Water:

a. Domestic Hot, Tempered, and Circulating Piping: Concealed Above Ceilings and in Walls: 1.5 inch thick rigid glass fiber with factory ASJ jacket.

b. Domestic Cold Piping: Concealed Above Ceilings and in Exterior Walls: 1 inch thick rigid glass fiber with factory ASJ jacket.

c. Exposed Piping Above 10ft Above Finished Floor Domestic Hot, Tempered, and Circulating Piping: 1.5 inch thick rigid glass fiber with factory ASJ jacket.

d. Exposed Piping Above 10ft Above Finished Floor Domestic Cold Piping: 1 inch thick rigid glass fiber with factory ASJ jacket.

e. Exposed Piping Below 10ft Above Finished Floor Domestic Hot, Tempered, and Circulating Piping: 1.5 inch thick rigid glass fiber with glass fabric vapor barrier jacket.

f. Exposed Piping Below 10ft Above Finished Floor Domestic Cold Piping:1 inch thick rigid glass fiber with glass fabric vapor barrier jacket.

2. Roof Drain Bodies: Flexible glass fiber; 1-1/2 inch thick.

3. Concealed Horizontal Roof Drainage Above Grade and Vertical Piping Above First Elbow: Flexible fiberglass blanket type, ½-inch minimum thick.

4. Exposed Horizontal Roof Drainage Above Grade and Vertical Piping Above First Elbow: Rigid fiberglass with ASJ;1/2 inch thick.

5. Roof Drain Overflow Piping: Insulate within 10 feet of the exterior connection.

6. Concealed Waste piping handling HVAC Condensate Above Grade:1 inch thick phenolic foam with Saran vapor jacket. Insulate fittings with pipe insulation mitered to fit.

7. Exposed Waste piping handling HVAC Condensate Above Grade: 1 inch thick phenolic foam with Saran vapor jacket and PVC finish jacket. Insulate fittings with pipe insulation mitered to fit.

END OF SECTION

SECTION 22 1005 - PLUMBING PIPING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Pipe, pipe fittings, specialties, and connections for piping systems.

1. Sanitary sewer
2. Domestic water
3. Natural Gas
4. Valves.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 22 0516 - Expansion Fittings and Loops for Plumbing Piping.

C. Section 22 0510 - General Plumbing Requirements.

D. Section 22 0553 - IDENTIFICATION FOR PLUMBING PIPING AND EQUIPMENT.

E. Section 22 0719 - PLUMBING PIPING INSULATION.

1.3 REFERENCE STANDARDS

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. ASME B16.1 - Gray Iron Pipe Flanges and Flanged Fittings: Classes 25, 125, and 250; 2010.

C. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2011.

D. ASME B16.18 - Cast Copper Alloy Solder Joint Pressure Fittings; 2012.

E. ASME B16.22 - Wrought Copper and Copper Alloy Solder-Joint Pressure Fittings; 2013.

F. ASME B16.29 - Wrought Copper and Wrought Copper Alloy Solder Joint Drainage Fittings - DWV; 2012.

G. ASME B31.1 - Power Piping; 2014.

H. ASME B31.2 - Fuel Gas Piping; The American Society of Mechanical Engineers; 1968.

I. ASME B31.9 - Building Services Piping; 2014.

J. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2012.

K. ASTM A74 - Standard Specification for Cast Iron Soil Pipe and Fittings; 2015.

L. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2015.

M. ASTM A 888 - Hubless Cast Iron Pipe and Fittings.

N. ASTM B32 - Standard Specification for Solder Metal; 2008 (Reapproved 2014).

O. ASTM B42 - Standard Specification for Seamless Copper Pipe, Standard Sizes; 2015a.

P. ASTM B75/B75M - Standard Specification for Seamless Copper Tube; 2011.

Q. ASTM B88 - Standard Specification for Seamless Copper Water Tube; 2014.

R. ASTM B88M - Standard Specification for Seamless Copper Water Tube (Metric); 2013.

S. ASTM B302 - Standard Specification for Threadless Copper Pipe, Standard Sizes; 2012.

T. ASTM B306 - Standard Specification for Copper Drainage Tube (DWV); 2013.

U. ASTM C564 - Standard Specification for Rubber Gaskets for Cast Iron Soil Pipe and Fittings; 2014.

V. ASTM C 1540-04- Standard Specification for Heavy Duty Shielded Couplings joining Hubless Cast Iron Soil Pipe and Fittings.

W. ASTM C 1563- Standard test method for Gaskets for use in Connection with Hub and Spigot Cast Iron Soil Pipe and Fittings for Sanitary Drain, Waste, Vent and Storm Piping Applications.

X. ASTM D1785 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe, Schedules 40, 80, and 120; 2015.

Y. ASTM D2466 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Pipe Fittings, Schedule 40; 2013.

Z. ASTM D2564 - Standard Specification for Solvent Cements for Poly(Vinyl Chloride) (PVC) Plastic Piping Systems; 2012.

AA. ASTM D2665 - Standard Specification for Poly(Vinyl Chloride) (PVC) Plastic Drain, Waste, and Vent Pipe and Fittings; 2014.

BB. AWWA C111/A21.11 - Rubber-Gasket Joints for Ductile-Iron Pressure Pipe and Fittings; 2012.

CC. AWWA C151/A21.51 - Ductile-Iron Pipe, Centrifugally Cast; 2009.

DD. AWWA C651 - Disinfecting Water Mains; 2005.

EE. CISPI 301 - Standard Specification for Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste and Vent Piping Applications; 2009.

FF. CISPI 310 - Specification for Coupling for Use in Connection with Hubless Cast Iron Soil Pipe and Fittings for Sanitary and Storm Drain, Waste, and Vent Piping Applications; 2011.

GG. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

HH. MSS SP-78 - Cast Iron Plug Valves, Flanged and Threaded Ends; 2011.

II. MSS SP-80 - Bronze Gate, Globe, Angle and Check Valves; 2013.

JJ. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

KK. MSS SP-110 - Ball Valves Threaded, Socket-Welding, Solder Joint, Grooved and Flared Ends; 2010.

LL. NFPA 54 - National Fuel Gas Code; National Fire Protection Association; 2006.

MM. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

NN. NSF 372 - Drinking Water System Components - Lead Content; 2011.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements, for submittal procedures.

B. Product Data: Provide data on pipe materials, pipe fittings, valves, and accessories. Provide manufacturers catalog information. Indicate valve data and ratings.

C. Project Record Documents: Record actual locations of valves.

1.5 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Refer to Section 22 0510 - General Plumbing Requirements for installer requirements.

C. All cast iron pipe and fittings shall be marked with the Collective Trademark of the Cast Iron Soil Pipe Institute.

D. All buried thermoplastic pipe and fittings shall be installed in accordance with ASTM D 2321.

E. Perform Work in accordance with State of Georgia, standards.

F. Valves: Manufacturer's name and pressure rating marked on valve body.

G. Welding Materials and Procedures: Conform to ASME BPVC-IX and applicable state labor regulations.

H. Identify pipe with marking including size, ASTM material classification, ASTM specification, potable water certification, water pressure rating.

I. Perform Work in accordance with State of Georgia plumbing code.

J. Conform to applicable code for installation of backflow prevention devices.

K. Disinfection shall be in accordance with Environmental Protection Division, Georgia Department of Natural Resources "Rules for Safe Drinking Water".

L. Domestic water piping system shall be sterilized, complying with Federal Specifications BB-C-120. Work shall be performed by licensed operator.

M. Water Sample Certification: Water samples from the sterilized domestic water piping system shall be tested and approved by the local Health Department.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.

B. Provide temporary protective coating on cast iron and steel valves.

C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.

D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.7 FIELD CONDITIONS

A. Do not install underground piping when bedding is wet or frozen.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Potable Water Supply Systems: Provide piping, pipe fittings, and solder and flux (if used), that comply with NSF 61 and NSF 372 for maximum lead content; label pipe and fittings.

2.2 SANITARY SEWER PIPING, BURIED AND WITHIN 5 FEET OF BUILDING

A. Cast Iron Pipe: ASTM A 74 service weight.

1. Fittings: Cast iron.

2. Joints: Hub-and-spigot, CISPI HSN compression type with ASTM C 564 gaskets or lead and oakum.

2.3 SANITARY SEWER PIPING, ABOVE SLAB ON GRADE:

A. Cast Iron Pipe: CISPI 301 or ASTM A888, hubless.

1. Fittings: Cast iron.

2. Joints: Shielded Couplings ASTM C 1277 Assembly: CISPI 310 and ASTM C 1540-04, with stainless steel shield, stainless steel clamp and tightening devices, and ASTM C 564 rubber sleeve.

a. Manufacturers - 1½" thru 3": Medium Duty: Mission Heavyweight, Husky HD 2000; Clamp-ALL-80, Tyler Wide Body, Ideal HD, Mifab XHUB.

b. Manufacturers - 4" thru 10": Heavy Duty: Husky SD 4000; Clamp-ALL-121, Mifab XHUB.

2.4 FORCE MAIN: (Elevator Sump Pump Piping)

A. Steel Pipe (Above Ground): ASTM A 53, Schedule 40 galvanized steel.

1. Galvanized Cast Iron Fittings: Flanged, 250 pound, ASTM A53, class B.

2.5 WATER PIPING, ABOVE SLAB ON GRADE:

A. Copper Tube: ASTM B 88 (ASTM B 88M), Type L (B), Drawn (H).

1. Fittings: ASME B16.18, ASME B16.22, wrought copper and bronze.

2. Joints: Grooved mechanical couplings.

3. Mechanical Press Sealed Fittings: Double pressed type, NSF 61 and NSF 372 approved or certified, utilizing EPDM, nontoxic synthetic rubber sealing elements.

a. Manufacturers:

1) Grinnell Products, a Tyco Business: www.grinnell.com.

2) Viega LLC: www.viega.com.

2.6 NATURAL GAS PIPING, ABOVE GRADE

A. Steel Pipe: ASTM A 53/A 53M Schedule 40 black.

1. Fittings: ASME B16.3, malleable iron, or ASTM A 234/A 234M, wrought steel welding type.

2. Joints: NFPA 54, threaded or welded to ASME B31.1.

B. Valve Connections: 2" and smaller - threaded; 2 1/2" and larger - flanged.

2.7 UNIONS, FLANGES AND COUPLINGS

A. Unions for Pipe Sizes 3 inch and Under:

1. Copper Tube and Pipe: Class 150 bronze unions with soldered joints.

B. Flanges for Pipe Sizes Over 1 inch:

1. Copper Tube and Pipe: Class 150 slip-on bronze flanges; preformed neoprene gaskets.

C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier. Provide where connecting ferrous and non-ferrous piping.

2.8 PIPE HANGERS AND SUPPORTS

A. Manufacturers: Anvil, B-Line, Grinnell, Globe or Michigan. Figure numbers are for Michigan.

B. Plumbing Piping - Drain, Waste, and Vent:

1. Hangers for Pipe Sizes 2 Inches and Over: Carbon steel, adjustable, clevis. Figure 400.

2. Multiple or Trapeze Hangers: Steel channels with welded spacers and hanger rods.

3. Wall Support for Pipe Sizes to 3 inch: Cast iron hook.

4. Wall Support for Pipe Sizes 4 inch and Over: Welded steel bracket and wrought steel clamp.

5. Floor Support: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

6. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

C. Plumbing Piping - Water:

1. Hangers for Pipe Sizes 1/2 Inch to 1-1/2 Inches: Carbon steel, adjustable swivel, loop. Figure 100.

2. Hangers for Cold Pipe Sizes 2 Inches and Over: Copper electroplated carbon steel , adjustable, clevis. Figure 402.

3. Multiple or Trapeze Hangers(Up to 2 inch: Green epoxy coated, cold formed, lipped steel channels, sized for pipe load and span, 1-5/8" x 1-5/8" x 12 gauge minimum, with pipe/tubing clamps, elastomer cushion, spring held, hardened steel nuts and hanger rods.

4. Multiple or Trapeze Hangers: Steel channels with welded supports or spacers and hanger rods.

5. Vertical Support: Steel riser clamp.

6. Floor Support for Cold Pipe: Cast iron adjustable pipe saddle, lock nut, nipple, floor flange, and concrete pier or steel support.

7. Copper Pipe Support: Carbon steel ring, adjustable, copper plated.

2.9 GATE VALVES

A. Domestic Cold Water 2-1/2 Inches and Larger:

1. Manufacturers:

a. Crane; Model

b. Nibco; Model

c. Kitz

d. Hammond; Model IR 1138

e. Stockham;

f. Watts;

g. Milwaukee Valve Company; Model F2882-A

2. MSS SP-70, NSF-61, Class 125, 150 psi CWP; Iron body, bronze trim, bronze seat, non-rising stem, cast or malleable iron handwheel, solid bronze wedge disc, flanged ends.

2.10 BALL VALVES

A. Up To and Including 2-1/2 Inches:

1. Manufacturers:

a. Apollo; Model 77WLF2 Series

b. FNW; Model 430

c. Hammond; Model UP8301A P28911

d. Jomar; Model JP-100G

e. Milwaukee; Model UPBA100 P2

f. Watts; Model LFFBV-3-PRESS-M2

g. American Valve; Model G111

2. MSS SP-110, NSF-61, 150 WSP, 200 WOG, Brass or Bronze two piece body, Full port, chrome plated brass ball, reinforced teflon seats and stuffing box ring, blow-out proof

stem design, adjustable packing gland, zinc coated steel lever handle with vinyl hand grip, Press Fit Ends.

2.11 GAS VALVES

A. 2-Inches and smaller

1. Manufacturers:

a. Apollo; Model 64:

b. Crane; Model 9200 Series:

c. Hammond; Model 8901

d. Jomar; Model T-100NE

e. Milwaukee Valve; Model BA475B

f. Stockham; Model S206-UFBR

g. Watts; Model FVB-3

B. MSS SP-110, 600 WOG, B16.44 5 PSIG, Z21.15 1/2 PSIG, Brass/bronze two piece body, full port, teflon packing, chrome plated brass ball, threaded ends.

2.12 PLUG VALVES

A. Manufacturers: 2 1/2" and larger, flanged

1. Resun; Model R-1431. www.rmenergy.com

2. Nordstrom Valves; www.flowserve.com

B. Construction 2" and smaller: MSS SP-78, 200 PSI WOG, ASTM A 126 Class B cast iron body and plug, stainless steel spring, glass filled TFE gasket, threaded or grooved ends. Provide lever operator with set screw.

2.13 THERMOSTATIC BALANCE VALVES

A. Manufacturers:

1. Acorn; Model TZV

2. Caleffi; Model Thermosetter

3. ITT Bell & Gossett; Model Temp Setter

4. Jomar; Model RecircSetter

5. ThermOmegaTech; Model Circuit Solver

B. ANSI/NSF-61 & NSF 372: Low Lead Brass y or Stainless Steel with internal components being corrosion resistant. Valve to have thermal actuator to modulate flow based on water temperature. Locate on hot water return piping after last fixture and size in accordance with manufacturer's requirements. Set at 100°F for valves with temperature setpoint. Valves shall be ANSI/NSF-61 Annex G Compliant

2.14 SWING CHECK VALVES

A. 2-Inches and smaller

1. Manufacturers:

a. Apollo; Model 161SLF

b. Crane; Model LF1340

c. Hammond Valve; Model UP912

d. Jomar; Model S-511G

e. Milwaukee Valve; Model UP1509

f. Red-White Valve Corp.; Model 237AB

g. Stockham; Model LFB-309Y

2. MSS SP-80, NSF-61, Class 125, bronze body and cap, bronze swing disc with rubber seat, solder ends

2.15 SPRING LOADED CHECK VALVES

A. 2-Inches and smaller

1. Manufacturers:

a. Hammond Valve; Model UP943

b. Conbraco/Apollo; Model 61-100.

c. Milwaukee Valve Company; Model UP548T

B. 250 psi Non-Shock WOG, bronze body, bronze spring, bronze disc, Buna disc ring, silent closing, threaded ends.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that excavations are to required grade, dry, and not over-excavated.

3.2 PREPARATION

A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.

B. Remove scale and dirt, on inside and outside, before assembly.

C. Prepare piping connections to equipment with flanges or unions.

3.3 INSTALLATION

A. Each type of pipe installed shall be by the same manufacturer throughout the building.

B. Each type of fittings installed shall be by the same manufacturer throughout the building.

C. Install in accordance with manufacturer's instructions.

D. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members. Attachments shall be to top cord of bar joists. Attach to beams with beam clamps. DO NOT support from roof deck.

E. Provide non-conducting dielectric connections wherever jointing dissimilar metals.

F. Route piping in orderly manner and maintain gradient. Route parallel and perpendicular to walls.

G. Install piping to maintain headroom, conserve space, and not interfere with use of space.

H. Maintain 4 inch clearance between pipe and fittings after insulation.

I. Group piping whenever practical at common elevations.

J. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.

K. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings.

L. Provide access where valves and fittings are not exposed.

M. Establish elevations of buried piping outside the building to ensure not less than 3 ft of cover.

N. Install vent piping penetrating roofed areas to maintain integrity of roof assembly.

O. Flush all debris and pipe compound from domestic water system.

P. Excavate in accordance with International Plumbing Code, Section 306.2.

Q. Backfill in accordance with International Plumbing Code, Section 306.3.

R. Install bell and spigot pipe with bell end upstream.

S. Install valves in a readily accessible location.

T. Install valves with stems upright or horizontal, not inverted. Refer to Section 22 0523.

U. Install water piping to ASME B31.9.

V. Sleeve pipes passing through partitions, walls and floors. Where pipes pass thru exterior walls, seal opening between sleeve and pipe.

W. Pipe Hangers and Supports:

1. Install in accordance with ASME B31.9.

2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.

3. Place hangers within 12 inches of each horizontal elbow.

4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.

6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.

7. Use double nuts and lock washers on threaded rod supports.

8. Provide copper plated hangers and supports for copper piping where hanger is in contact with tubing.

9. Prime coat concealed steel hangers and supports not provided with a corrosion resistant finish. Refer to Section 09 9000.

10. Support drainage piping within 12 inches of every joint.

11. Provide rigid sway bracing upstream of all changes in direction greater than 45 degrees for horizontal storm and sanitary drainage piping 4" and larger.

3.4 APPLICATION

A. Install unions downstream of valves and at equipment or apparatus connections.

B. Install ball valves for shut-off and to isolate equipment, part of systems, or vertical risers as shown on drawings.

C. Provide spring-loaded check valves on discharge of water pumps.

D. Provide flow controls in water recirculating systems where indicated.

3.5 TOLERANCES

A. Drainage Piping: Establish invert elevations within 1/2 inch vertically of location indicated and slope to drain at minimum of 1/8 inch per foot slope.

B. Interior Water Piping: Maintain top of piping level with concentric reducers. Arrange to drain at low points.

3.6 DISINFECTION OF DOMESTIC WATER PIPING SYSTEM

A. Prior to starting work, verify system is complete, flushed, and clean.

B. Ensure acidity (pH) of water to be treated is between 7.4 and 7.6 by adding alkali (caustic soda or soda ash) or acid (hydrochloric).

C. Inject disinfectant, free chlorine in liquid, powder, tablet, or gas form throughout system to obtain 50 to 80 mg/L residual.

D. Bleed water from outlets to ensure distribution and test for disinfectant residual at minimum 15 percent of outlets.

E. Maintain disinfectant in system for 24 hours.

F. If final disinfectant residual tests less than 25 mg/L, repeat treatment.

G. Flush disinfectant from system until residual equal to that of incoming water or 1.0 mg/L.

H. Take samples no sooner than 24 hours after flushing, from 10 percent of outlets and from water entry, and analyze in accordance with AWWA C651.

3.7 SCHEDULES

A. Hanger spacing indicated as maximum span based on pipe material and size. Conform to structural spacing and load capacity of structural support points and provide closer spacing as required.

B. Pipe Hanger Spacing:

1. Metal Piping:

a. Copper Pipe size: 1/2 inches to 1-1/4 inches:

1) Maximum hanger spacing: 5 ft.

2) Hanger rod diameter: 3/8 inches.

b. Copper Pipe size: 1-1/2 inches to 2 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 3/8 inch.

c. Copper Pipe size: 2-1/2 inches to 4 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 1/2 inch.

d. Waste/Vent Pipe size: 2 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 3/8 inch.

e. Waste/Vent Pipe size: 3 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 1/2 inch.

f. Waste/Vent Pipe size: 4 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 5/8 inch.

g. Storm Pipe size: 4 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 5/8 inch.

h. Storm Pipe size: 6 inches to 8 inches:

1) Maximum hanger spacing: 8 ft.

2) Hanger rod diameter: 3/4 inch.

i. Storm Pipe size: 10 inches to 12 inches:

1) Maximum hanger spacing: 10 ft.

2) Hanger rod diameter: 7/8 inch.

END OF SECTION

SECTION 22 1006 - PLUMBING PIPING SPECIALTIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Floor Drains

B. Cleanouts

C. Hose Bibbs

D. Water hammer arrestors

E. Digital Mixing Valve

F. Trap Sealer Assembly

G. Flashing

1.2 RELATED REQUIREMENTS

A. Section 22 0510 - General Plumbing Requirements

B. Section 22 0519 - Meters and Gages for Plumbing Piping

C. Section 22 1005 - Plumbing Piping

1.3 REFERENCE STANDARDS

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. ASME A112.6.3 - Floor and Trench Drains; 2001 (R2007).

C. ASSE 1011 - Hose Connection Vacuum Breakers; 2004.

D. ASSE 1012 - Backflow Preventer with Intermediate Atmospheric Vent; 2009.

E. NSF 61 - Drinking Water System Components - Health Effects; 2014 (Errata 2015).

F. NSF 372 - Drinking Water System Components - Lead Content; 2011.

G. PDI-WH 201 - Water Hammer Arresters; 2010.

1.4 SUBMITTALS

A. See Section 01 3000 - Administrative Requirements for submittal procedures.

B. Refer to Section 22 0510 - General Plumbing Requirements, for submittal requirements.

C. Product Data: Provide component sizes, rough-in requirements, service sizes, and finishes.

D. Manufacturer's Instructions: Indicate Manufacturer's Installation Instructions: Indicate assembly and support requirements.

E. Project Record Documents: Record actual locations of equipment, cleanouts, backflow preventers, piping and valves.

1.5 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years documented experience.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Accept specialties on site in original factory packaging. Inspect for damage.

1.7 EXTRA MATERIALS

A. Two hose end vacuum breakers for hose bibs.

PART 2 PRODUCTS

2.1 GENERAL REQUIREMENTS

A. Specialties in Potable Water Supply Systems: Provide products that comply with NSF 61 and NSF 372 for maximum lead content.

2.2 FLOOR DRAINS

A. Floor Drain (FD-A): In Finished Spaces

1. Manufacturers:

a. Josam; Model 30000-S-Y

b. Mifab; Model F1100C-S(P)-1

c. J. R. Smith; Model 2005L(B)

d. Wade; Model 1100G(TY)

e. Watts; Model FD-100-M-P

f. Zurn; Model ZN415S(NL)

2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, square, adjustable nickel-bronze strainer.

B. Floor Drain (FD-B): In Mechanical Spaces

1. Manufacturers:

a. Josam; Model 32300V-50-69-1

b. Mifab; Model F1340-Y-14

c. J. R. Smith; Model 2131L-P050-B-NB

d. Wade; Model 1210(TY)-1-27

e. Watts; Model FD-340-Y-P

2. ASME A112.6.3; lacquered cast iron two piece body with double drainage flange, weep holes, reversible clamping collar, and adjustable round nickel bronze strainer with removable perforated sediment bucket.

C. Floor Drain (FD-C): Indirect Waste

1. Manufacturers:

a. Josam; Model 49000-X-3

b. Mifab; Model FS1520-FL-1-150

c. J. R. Smith; Model 3100C-12

d. Watts; Model FS710-F-150

e. Zurn; Model ZN-1910-K

2. ASME A112.6.3; lacquered cast iron flanged receptor with seepage holes, acid resistant coated interior and 8 1/2 - inch square nickel bronze rim with 1/2 grate and dome strainer.

D. THE BELOW FLOOR SINK COMES IN 2" THRU 8" SIZES.

2.3 CLEANOUTS

A. Cleanouts at Interior Finished Floor Areas (FCO):

1. Manufacturers:

a. Josam; Model 55000

b. Mifab; Model C-1100P-R

c. J.R. Smith; Model 4032L

d. Watts; Model

e. Zurn; Model ZN1400-NL-BP

f. Wade; Model 6000-1-75

2. Lacquered cast iron body with anchor flange, flashing clamp and reversible clamping collar, round adjustable secured Nickel Bronze top assembly with bronze plug and round gasketed scored cover in service areas and round gasketed depressed cover to accept floor finish in finished floor areas.

B. Cleanouts at Interior Finished Wall Areas (WCO):

1. Manufacturers:

a. Josam; Model 58600

b. Mifab; Model C-1430-RD

c. J.R. Smith; Model 4472

d. Watts; Model CO-590-RD

e. Zurn; Model Z-1468

f. Wade; Model 8590/8304

2. Line type with cast bronze taper threaded plug with round stainless steel access cover secured with machine screw.

2.4 HOSE BIBBS

A. Interior Hose Bibbs:

1. Manufacturers:

a. Nibco; Model 763VB-LS

b. Woodford; Model 24P

c. T&S Brass; Model B-0736

d. Prier; Model C255CP

2. Brass body with integral mounting flange, replaceable hexagonal disc, hose thread spout, chrome plated where exposed with lockshield and removable key, integral vacuum breaker in conformance with ASSE 1011. Rough brass finish in mechanical spaces.

2.5 WATER HAMMER ARRESTORS

A. Manufacturers: Unit Size: 'A'

1. Jay R. Smith; Model 5205-SC Series

2. Watts; Model LF15M2 Series

3. Mifab; Model MWH-A
4. Sioux Chief; Model 650 Series
5. Josam; Model 75001-S
6. Wade; Model 5P
7. Wilkins; Model 1250XL-A
8. Zurn; Model WH2950-A-XL

B. Manufacturers: Unit Size: 'B'

1. Jay R. Smith; Model 5210-SC Series
2. Watts; Model LF15M2 Series
3. Mifab; Model MWH-B
4. Sioux Chief; Model 650 Series
5. Josam; Model 75002-S
6. Wade; Model 10P
7. Wilkins; Model 1250XL-B
8. Zurn; Model WH2950-B-XL

C. Manufacturers: Unit Size: 'C'

1. Jay R. Smith; Model 5220-SC Series
2. Watts; Model LF15M2 Series
3. Sioux Chief; Model 650 Series
4. Josam; Model 75003-S
5. Wade; Model 20P
6. Wilkins; Model 1250XL-C
7. Zurn; Model WH2950-C-XL

D. Manufacturers: Unit Size: 'D'

1. Jay R. Smith; Model 5230-SC Series
2. Watts; Model LF15M2 Series

3. Sioux Chief; Model 650 Series
4. Josam; Model 75004-S
5. Wade; Model 50P
6. Wilkins; Model 1250XL-D
7. Zurn; Model WH2950-D-XL

E. Water Hammer Arrestors:

1. ANSI A112.26.1M Copper construction, piston type sized in accordance with PDI-WH 201, precharged suitable for operation in temperature range 33 to 180 degrees F and maximum 150 psi working pressure. Locate valve(s) above ceiling height of adjacent space.

2.6 DIGITAL MIXING VALVES

A. Digital Water Mixing Valves:

1. Manufacturers:
   a. Lawler; Model Neptune EMX 075
   b. Leonard.
   c. Power; Model Intellistation LFIS075VL.
   d. Symmons.
2. System shall control water temperature to +/- 2°F in accordance with ASSE 1017 and resist "temperature creep" during periods of low/zero demand. Controller shall be password protected and feature a user-adjustable outlet temperature range of 60 - 180°F with high and low temperature alerts, and an approach temperature of 2°F.
3. System shall digitally control and monitor mixed outlet temperature. Controller shall integrate with building automation systems (separate module not required) through BACnet and Modbus protocols and feature local and remote temperature alarms. System will feature a user-set, high-temperature sanitization mode for thermal disinfection of bacteria and a programmable temperature set back feature to improve energy efficiency. System will also feature high speed actuator with override feature. In the event of a power failure, system will open full cold supply. In case of a loss of cold water, the system will close hot water supply.
4. System shall be listed/approved to ASSE 1017, cUPC, NSF, CSA 24/UL873 and BTL (BACnet Testing Laboratories)
5. Capacity: 16 gpm at 5 psi differential.

2.7 TRAP SEALER ASSEMBLY

A. Manufacturers:

1. Sure Seal
2. Proset
3. J.R. Smith
4. Mifab

B. Inline elastomeric material waterless trap protection. Size to match drain.

C. Ten year warranty

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install plumbing specialties in a readily accessible location.

C. Extend cleanouts to finished floor or wall surface. Lubricate threaded cleanout plugs with mixture of graphite and linseed oil. Ensure clearance at cleanout for rodding of drainage system.

D. Install floor cleanouts at elevation to accommodate finished floor.

E. Floor drains shall be set at 1/8-inch below finish floor elevation. Refer to Architectural for sloping of floor.

F. Install approved potable water protection devices on plumbing lines where contamination of domestic water may occur; on boiler feed water lines, fire sprinkler systems, and irrigation systems.

G. Install water hammer arrestors complete with accessible isolation valve on hot and cold water supply piping to , , all fixtures and toilet batteries. Size and install in accordance with the (Plumbing and Drainage Institute Standard) PDI WH-201.

END OF SECTION

SECTION 22 3000 - PLUMBING EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water Heaters

B. Pumps

C. In-Line Circulators.

D. Submersible Sump Pumps

1.2 RELATED REQUIREMENTS

A. Section 22 0519 - Meters and Gages For Plumbing Piping.

B. Section 26 0583 - Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. NFPA 70 - National Electrical Code; 2023.

1.4 SUBMITTALS

A. Refer to Section 22 0510 - General Plumbing Requirements for submittal procedures.

B. Product Data:

1. Provide dimension drawings of water heaters indicating components and connections to other equipment and piping.

2. Indicate pump type, capacity, power requirements.

3. Provide certified pump curves showing pump performance characteristics with pump and system operating point plotted. Include NPSH curve when applicable.

4. Provide electrical characteristics and connection requirements.

C. Operation and Maintenance Data: Include operation, maintenance, and inspection data, replacement part numbers and availability, and service depot location and telephone number.

D. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner's name and registered with manufacturer.

E. Certificate: Provide Manufacturer's start-up certificate certifying the unit is installed in accordance with the manufacturer's recommendations.

1.5 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

C. Identification: Provide pumps with manufacturer's name, model number, and rating/capacity identified by permanently attached label.

D. Standards: Ensure products and installation of specified products are in conformance with recommendations and requirements of the following organizations:

1. American Society of Mechanical Engineers (ASME).

2. National Board of Boiler and Pressure Vessel Inspectors (NBBPVI).

3. National Electrical Manufacturers' Association (NEMA).

4. Underwriters Laboratories (UL).

E. Performance: Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, operate within 25 percent of midpoint of published maximum efficiency curve.

1.6 CERTIFICATIONS

A. Water Heaters: NSF approved.

B. Electric Water Heaters: UL listed and labeled to UL 174 or UL 1453.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Provide temporary inlet and outlet caps. Maintain caps in place until installation.

1.8 WARRANTY

A. Provide warranties from date of Final Completion.

B. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

C. Provide five year manufacturer warranty for domestic water heaters.

D. Submersible Sump Pump: Provide a one year warranty.

PART 2 PRODUCTS

2.1 COMMERCIAL ELECTRIC WATER HEATERS

A. STORAGE TYPE WATER HEATER

1. Manufacturers:
    a. A.O. Smith
    b. Bradford White
    c. Lochinvar
2. Type: Automatic, electric, vertical storage, Tall
3. Performance: (WH-3)
    a. Storage capacity: 120 gal.
    b. Heating element size: 6 kW
    c. Number of heating elements: 6
    d. Minimum recovery rate: 147 gph with 100 degrees F temperature rise.
    e. Maximum working pressure: 150 psig.
4. Electrical Characteristics:
    a. See Electrical. Three Phase Non-Simultaneous
5. Tank: Glass lined welded steel, thermally insulated with foam insulation; encased in corrosion-resistant steel jacket; baked-on enamel finish.
6. Controls: Automatic water thermostat with externally adjustable temperature range from 110 to 170 degrees F for single element, medium watt density zinc plated copper elements. Factory installed manual reset high temperature cutoff and factory installed junction box where required.
7. Accessories: Provide:
    a. Top Water Connections: Brass.
    b. Dip tube: Brass.
    c. Drain Valve.
    d. Anode: Magnesium
    e. ASME Rated Temperature and Pressure Relief Valve

f. See detail on drawing.

B. Tankless Electric Water Heater: (WH-4)

1. Manufacturers:

a. Chronomite, Inc; Model CMI-40L/208

b. Emax;

c. Rheem;

2. Capacity: 38 degree F rise at minimum rate of 1.5 gpm.

3. Heater Type: Self-contained, wall-mounted unit capable of handling listed capacity, with integrated thermostatic mixing valve, water-inlet strainer, removable thermally-insulated front panel, and threaded water pipe-end connections.

4. Electrical Characteristics: 208v

2.2 VACUUM RELIEF VALVE

A. All bronze construction with silicone disc, integral body seat and brass working parts. Maximum water pressure 200 psi; maximum steam pressure 15 psi; maximum temperature 250 degrees Fahrenheit.

B. Manufacturers: Watts N36, Cash Acme VR-801, or Wilkins VR10.

2.3 THERMAL EXPANSION TANKS

A. Manufacturers:

1. Amtrol Inc

2. ITT Bell & Gossett

3. Taco, Inc

4. Watts;

5. Zilmet;

B. Construction: Welded steel, tested and stamped in accordance with ASME BPVC-VIII-1; supplied with National Board Form U-1, rated for working pressure of 125 psig, withheavy duty butyl diaphragm sealed into tank, and steel legs or saddles.

C. Accessories: Pressure gage and air-charging fitting with purge valve, tank drain; precharge to 55 psig.

D. Size: See detail on drawings.

2.4 PUMPS

A. IN-LINE CIRCULATOR PUMPS

1. Manufacturers:

a. Armstrong Pumps Inc: www.armstrongpumps.com.

b. Grundfoss.

c. ITT Bell & Gossett: www.bellgossett.com.

d. TACO.

2. Casing: Bronze or Stainless Steel, rated for 125 psig working pressure, with stainless steel rotor assembly.

3. Impeller: Non-Metallic or Noryl

4. Shaft: Ceramic or Carbon Steel, self-lubricating or permanently lubricated with steel ball bearings.

5. O-Ring and Gaskets: EPDM.

6. Drive: Direct Drive.

7. Performance:

a. Flow: 1.48 gpm, at 4.59 feet head.

b. Electrical Characteristics:

1) 1/40 hp.

2) 120 volts, single phase, 60 Hz, 15 minimum circuit ampacity.

B. SUBMERSIBLE ELEVATOR SUMP PUMP WITH OIL ALARM SYSTEM (3 REQUIRED)

1. Manufacturers:

a. Bell & Gossett

b. Goulds Pumps

c. Zoeller Pump Company: Model N161 with 10-2149 Control Panel

d. Myers Pumps; www.myers.com.

e. Weil Pump

f. Liberty Pumps

2. Type: Completely submersible, vertical, centrifugal, semi-open, non-clog.

3. Casing: Cast iron pump body and oil filled motor chamber.

4. Shaft: stainless steel.

5. Impeller: Bronze; open non-clog.

6. Bearings: Ball bearings.

7. Accessories: Oil Smart Pump Switch and Oil Smart Simplex Alarm Panel. 4x NEMA Enclosure with audible, light alarms, and dry contacts. Preset on and off points to differentiate oil detection and high water alarms for maintenance personnel. 20amp internal relay, and 304 Stainless Steel probes with UL508 approved switch. Dry contacts to allow for remote mounting control panel in mechanical room. Separate dry contacts in panel to provide an alarm signal to Building Automation System(BAS) indicating oil presence in elevator pit.

8. Performance:

   a. Flow: 50 GPM, at 29 feet lift.

   b. Motor: 3/4 HP, 120 volt, single phase, 60 Hz.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install plumbing equipment in accordance with manufacturer's instructions, as required by code, and complying with conditions of certification, if any.

B. Provide dielectric unions between the distribution piping and the cold and hot water connection piping provided with the water heater.

C. Coordinate with plumbing piping and related electrical work to achieve operating system.

D. Domestic Water Heaters:

1. Install water heater on concrete housekeeping base, sized minimum 4 inches larger than heater base. Refer to Section 22 0510.

2. Pipe relief valves to floor.

3. Pipe drains to nearest floor drain.

4. Provide piping connections and accessories as indicated.

5. Install circulator and blenders as detailed on Drawings.

6. Provide for connection to electrical service. Refer to Section 26 2717.

E. Pumps:

1. Provide line sized isolating valve and strainer on suction and line sized soft seated check valve and balancing valve on discharge.

2. Decrease from line size with long radius reducing elbows or reducers. Support piping adjacent to pump such that no weight is carried on pump casings. Provide supports under elbows on pump suction and discharge line sizes 4 inches and over.

3. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

F. Submersible Sump Pumps:

1. Ensure shaft length allows sump pumps to be located minimum 24 inches below lowest invert into sump pit and minimum 6 inches clearance from bottom of sump pit.

2. Provide line sized soft seated check valve and isolating valve on discharge.

3. Provide air lock hole between pump discharge and check valve where required by manufacturer.

4. Mount level control in accordance with manufacturer's recommendations.

5. Decrease from line size with long radius reducing elbows or reducers.

6. Ensure pumps operate at specified system fluid temperatures without vapor binding and cavitation, are non-overloading in parallel or individual operation, and operate within 25 percent of midpoint of published maximum efficiency curve.

3.2 STARTING EQUIPMENT.

A. Demonstrate water heater operation and verify specified performance.

B. Sump Pump:

1. Maintain basin is clean and free of debris.

2. Ensure level floats operate free and clear.

3. Adjust level controls.

4. Fill pit with water and mark On-Off levels on pit.

C. Provide start-up certificate for water heater.

END OF SECTION

SECTION 22 4010 - PLUMBING FIXTURES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Water closets (WC)

B. Urinals (UR)

C. Wall Hung Lavatories (LV)

D. Counter Mounted Lavatories (LV)

E. Sinks (SK)

F. Mop Basins (MB)

G. Ice Maker Supply Box (IB)

H. Electric Water Coolers (EWC)

I. Plumbing Fixtures' Fittings, Accessories, and Supplies

1.2 RELATED SECTIONS

A. Section 01 3000 - Administrative Requirements for submittal procedures

B. Section 01 6000 - Product requirements

C. Section 01 7700 - Closeout Procedures

D. Section 07 9200 - Joint Sealants: Seal fixtures to walls and floors.

E. Section 22 0510 - General Plumbing Requirements

F. Section 26 2717 - Equipment Wiring.

1.3 REFERENCES

A. NSF/ANSI 372 - American National Standard for procedures in evaluating product compliance with the 0.25% maximum weighted average lead content requirement.

B. ARI 1010 - Self-Contained, Mechanically-Refrigerated Drinking-Water Coolers; Air-Conditioning and Refrigeration Institute; 1994.

C. ASME A112.6.1M - Supports for Off-the-Floor Plumbing Fixtures for Public Use; The American Society of Mechanical Engineers; 1997.

D. ASME A112.18.1 - Plumbing Fixture Fittings; The American Society of Mechanical Engineers; 2000.

E. ASME A112.19.2M - Vitreous China Plumbing Fixtures; The American Society of Mechanical Engineers; 1998.

F. ASME A112.19.5 - Trim for Water-Closet Bowls, Tanks and Urinals; The American Society of Mechanical Engineers; 1999.

1.4 SUBMITTALS

A. Refer to Section 01 3000 - Administrative Requirements for submittal procedures

B. Refer to Section 22 0510 - General Plumbing Requirements for submittal procedures.

C. Product Data: Provide catalog illustrations of fixtures, sizes, rough-in dimensions, utility sizes, trim, and finishes.

D. Manufacturer's Instructions: Indicate installation methods and procedures.

E. Maintenance Data: Include fixture trim exploded view and replacement parts lists.

F. Warranty: Submit manufacturer warranty and ensure forms have been completed in the Owner 's name and registered with manufacturer.

1.5 QUALITY ASSURANCE

A. Products specified this section to be installed in a potable water system anticipated for human consumption shall be in compliance with the amended Safe Drinking Water Act S.3874, to reduce lead in drinking water. "Reduction of Lead in Drinking Water Act". 0.25% allowable lead content.

B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.6 REGULATORY REQUIREMENTS

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.7 DELIVERY, STORAGE, AND PROTECTION

A. Accept fixtures on site in factory packaging. Inspect for damage.

B. Protect installed fixtures from damage by securing areas and by leaving factory packaging in place to protect fixtures and prevent use.

1.8 WARRANTY

A. See Section 01 7700 - Closeout Procedures for additional submittal and warranty

B. Provide five year manufacturer warranty for electric water cooler from Final Observation.

1.9 EXTRA MATERIALS

A. See Section 01 6000 - Project Requirements.

B. Supply two sets of faucet washers.

PART 2 PRODUCTS

2.1 FLUSH VALVE WATER CLOSETS

A. FIXTURE 'WC1'; WATER CLOSET (FM, FV (1.28 gpf), STD)

1. Bowl:

a. Manufacturers:

1) American Standard Inc: Model 2234.001

2) Kohler Company: Model K-96053

3) Toto: Model CT705UN

4) Sloan: Model ST-2009

5) Zurn: Model Z5655-BWL1

b. ASME A112.19.2M; 1.28 gpf, floor mounted vitreous china closet bowl with elongated rim, 1-1/2 inch top spud, china bolt caps; standard accessible.

2. Fixture Accessories:

a. Seat: Type 1St; See SEATS.

b. Flush Valve (1.28gpf): Type 1FV; See FLUSH VALVES.

B. FIXTURE 'WC2'; WATER CLOSET (FM, FV(1.28 gpf), ADA)

1. Bowl:

a. Manufacturers:

1) American Standard Inc: Model 3043.001

2) Kohler Company: Model K-96057

3) Toto: Model CT705ULN

4) Sloan: Model ST-2029

5) Zurn: Model Z5665-BWL1

b. ASME A112.19.2M; 1.28 gpf, floor mounted vitreous china closet bowl with elongated rim, 1-1/2 inch top spud, china bolt caps; disabled accessible.

2. Fixture Accessories:

a. Seat: Type 1St; See SEATS.

b. Flush Valve (1.28gpf): Type 2FV; See FLUSH VALVES.

C. FIXTURE 'WC3'; 15" WIDE COMBINATION UNIT (Contractor to coordinate installation and model numbers with drawings.)

1. Bowl:

a. Manufacturers:

1) Willoughby; Model ECF-1546-C-ON-BPH-1.28 GPF HET-PML2-PBH-PT-COHB4

2) Bradley:

3) Acorn:

2. 14-gauge, type 304 stainless steel; all welded polished to a satin finish. Elongated toilet bowl, with contoured seat; integral crevice free self-draining flushing rim with positive after fill and fully enclosed 2 1/2" O.D. trap minimum 2" seal. Lavatory bowl 12.75" x 8.25" x 5" deep; stainless steel filler/bubbler drain and 1 1/2" elbow waste, Unit shall be back accessible.

D. FIXTURE 'WC4'; 15" WIDE COMBINATION UNIT ADA (Contractor to coordinate installation and model numbers with drawings.)

1. Bowl:

a. Manufacturers:

1) Willoughby; Model

2) Bradley:

3) Acorn:

2. 14-gauge, type 304 stainless steel; all welded polished to a satin finish. Elongated toilet bowl, with contoured seat; integral crevice free self-draining flushing rim with positive after fill and fully enclosed 2 1/2" O.D. trap minimum 2" seal. Lavatory bowl 12.75" x 8.25" x 5" deep; stainless steel filler/bubbler drain and 1 1/2" elbow waste, ADA Accessible. Unit shall be back accessible.

2.2 URINALS

A. FIXTURE 'UR1'; URINAL (WH,FV (0.125 gpf), ADA)

1. Urinal:

a. Manufacturers:

1) American Standard Inc; Model 6590.001

2) Sloan; Model SU-1009

3) Zurn; Model Z5755

4) Toto; Model UT445U

5) Kohler Company; Model K-4904-ET

b. ASME A112.19.2M; 0.125 gpf, vitreous china, wall hung wash-out urinal fixture with integral trap, 3/4" top spud, Disabled accessible.

2. Flush Valve (0.125gpf): Type 4FV.

3. Urinal Carriers: See CARRIERS.

2.3 WALL HUNG LAVATORIES

A. FIXTURE 'LV1'; LAVATORY (WH, VC, ADA)

1. Lavatory Basin:

a. Manufacturers:

1) American Standard; Model 0355.012

2) Kohler; Model K-2005

3) Sloan; Model SS-3003

4) Toto; Model LT307.4

5) Zurn; Model Z5344

b. ASME A112.19.2M; vitreous china, wall hung, 21" x 18" fixture with drillings on 4-inch centers, front overflow, soap depression, drilled for concealed arm carrier, disabled accessible.

2. Accessories:

a. Faucet: Type 3F; See FAUCETS

b. Drain: Type 2D; See DRAINS.

c. Supplies: See SUPPLY STOPS.

d. Trap: Type 1T; See TRAPS.

e. Carrier: See CARRIERS; Concealed Arm Type.

f. Insulation: See FIXTURE INSULATION.

B. FIXTURE 'LV2'; LAVATORY (WH, VC, ADA)

1. Lavatory Basin:

a. Manufacturers:

1) American Standard; Model 0355.012

2) Kohler; Model K-2005

3) Sloan; Model SS-3003

4) Toto; Model LT307.4

5) Zurn; Model Z5344

b. ASME A112.19.2M; vitreous china, wall hung, 21" x 18" fixture with drillings on 4-inch centers, front overflow, soap depression, drilled for concealed arm carrier, disabled accessible.

2. Accessories:

a. Faucet: Type 4bF; See FAUCETS

b. Drain: Type 2D; See DRAINS.

c. Supplies: See SUPPLY STOPS.

d. Trap: Type 1T; See TRAPS.

e. Carrier: See CARRIERS; Concealed Arm Type.

f. Insulation: See FIXTURE INSULATION.

2.4 COUNTER MOUNTED LAVATORIES

A. FIXTURE 'LV3'; LAVATORY (CT, VC, ADA)

1. Lavatory Basin:

a. Manufacturers:

1) American Standard; Model 0476.028

2) Kohler; Model K-2196-4

3) Sloan; Model SS-3002

4) Toto; Model LT501.4

5) Zurn; Model Z5114

b. ASME A112.19.2M; counter mounted, vitreous china, 20" x 17" oval with drillings on 4-inch centers, front overflow, soap depression, disabled accessible.

2. Accessories:

a. Faucet: Type 4bF; See FAUCETS.

b. Drain: Type 2D; See DRAINS.

c. Supplies: See SUPPLY STOPS.

d. Trap: Type 1T; See TRAPS.

e. Insulation: See FIXTURE INSULATION.

2.5 COUNTER MOUNTED SINKS

A. FIXTURE 'SK1'; SINK (SS, CT, 25" x 22" SC)

1. Sink:

a. Manufacturers:

1) Elkay; Model DLR-252110

2) Just; Model SLX-2225-A-GR

3) Advance-Tabco; Model SS-1-2225-10

b. ASME A112.19.3M; 18 gauge, type 304 stainless steel, single compartment extra deep 25 x 22 x 6.5 -inches overall with 4 - hole drilling for faucet, 3-inch drain opening.

2. Accessories:

a. Faucet: Type 8F; See FAUCETS.

b. Drain: Type 4D; See DRAINS.

c. Supplies: Type SS5. See SUPPLIES.

d. Trap: Type 2T; See TRAPS.

B. FIXTURE 'SK2'; SINK (SS, CT, 22" x 17" SC, ADA)

1. Sink:

    a. Manufacturers:

        1) Elkay; Model LRAD-1722

        2) Just; Model SL-ADA-2217-A-GR

        3) Acorn; Model SDADA-1722-55-1

        4) Advance-Tabco; Model SS-1-2217-ADA

    b. ASME A112.19.3M; 18 gauge, type 304 stainless steel, single compartment 22 x 17 x 6 -inches overall with 3 -hole drilling for faucet, 3-inch drain opening; ADA accessible.

2. Accessories:

    a. Faucet: Type 7F; See FAUCETS.

    b. Drain: Type 6D; See DRAINS.

    c. Supplies: Type SS5. See SUPPLIES.

    d. Trap: Type 2T; See TRAPS.

    e. Insulation: See FIXTURE INSULATION.

C. FIXTURE 'SK3'; SINK (SS, CT, 33" x 22" DC, ADA)

1. Sink:

    a. Manufacturers:

        1) Elkay; Model LRAD-3322

        2) Just; Model DL-ADA-2233-A-GR

        3) Acorn; Model DDADA-3322-55-1

        4) Advance-Tabco; Model SS-2-3322-ADA

    b. ASME A112.19.3M; 18 gauge, type 304 stainless steel, double compartment 33 x 22 x 6 -inches overall with 4 -hole drilling for faucet, two 3-inch drain openings.

2. Accessories:

    a. Faucet: Type 8F; See FAUCETS.

    b. Drain: Type 6D; See DRAINS. 2 Required.

    c. Supplies: Type SS5. See SUPPLIES.

d. Trap: Type 2T; See TRAPS.

e. Cont. Drain: Type 7D; See DRAINS.

f. Insulation: See FIXTURE INSULATION.

2.6 MOP BASINS

A. FIXTURE 'MB1'; MOP BASIN (TERRI, FM 24" x 24" x 12")

1. Mop Basin:

a. Manufacturers:

1) Acorn; Model TDF-24

2) Fiat; Model TSB3000

3) Stern-Williams; Model HL-1800

b. ASME A112.19.1M terrazzo stone, one piece basin, 24 x 24 x 12-inches overall with drop front, stainless steel cap on threshold, integral stainless steel grate with quick connect drain.

2. Accessories:

a. Faucet: Type 11F; See FAUCETS.

b. Hose & Bracket: Type 12F; See FAUCETS.

2.7 MISCELLANEOUS FIXTURES

A. FIXTURE 'IB1'; ICEMAKER SUPPLY BOX

1. Icemaker Box Assembly

a. Manufacturers:

1) Guy-Gray; Model BIM 875AB

2) Water-Tite; Model AB9700

b. 20-gauge steel with powder-coated white finish or polystyrene plastic; 1/2"-inch FIP inlet by 1/4"-inch outlet compression angle valve with 1/2"-inch MPT connection. Angle valve to be low-lead to comply with NSF-61.

2.8 ELECTRIC WATER COOLERS

A. FIXTURE 'EWC'; ELECTRIC WATER COOLER (HI-LO w/Bottle Filling Station)

1. Water Cooler

a. Manufacturers:

1) Elkay; Model LZSTL8WSLK

2) Haws; Model

3) Halsey-Taylor; Model

4) Oasis; Model P8SBFSL

5) Murdock; Model A172108F-UG-BF12-BCD-WF1EZ

b. ARI-1010; Bi-level, with ADA unit on the right, wall mounted electric water cooler assembly with stainless steel water surfaces, heavy duty galvanized steel wall mounting frame, 'sandstone' paint or vinyl finish cabinet, elevated anti-squirt bubblers with stream guard, automatic stream regulators; front and side push button actuators; high efficiency cooling tank and air cooled coil delivering 8.0 gph 50-degree water at 90-degree ambient air temperature; with ADA compliant bottle filling station. Bottle filling station to have no touch sensor activation with 30 second shut-off timer, filter, and 1.1 gpm flow rate.

2. Accessories:

a. Supply: See SUPPLY STOPS

b. Trap: Type 1T; See TRAPS

c. Carriers: See CARRIERS

2.9 FIXTURE ACCESSORIES

A. FLUSH VALVES

1. Type 10FV (Standard & ADA Electronic Water Closet Valve- Diaphragm Type)

a. Manufacturers:

1) Sloan; Regal Optima 111-1.28-SMO-YBYC-YK-XL

2) Zurn 'Aqua Vantage-Aqua Sense'; Model ZER6000AV-HET-CPM-YK

b. ASME A112.18.1; Exposed chrome plated diaphragm type with 6VDC-4AA battery powered infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 1 1/2 inch top spud, 11 1/2-inches high; 1 solid-ring support; 1.28gpf maximum flush.

2. Type 14FV (Standard & ADA Electronic Urinal Valve- Diaphragm Type)

a. Manufacturers:

1) Sloan; Regal Optima 186-0.125-SMO-YBYC-YK-XL

2) Zurn 'Aqua Vantage-Aqua Sense'; Model ZER6003AV-ULF-CPM-YK

b. ASME A112.18.1; Exposed chrome plated diaphragm type with 6VDC-4AA battery powered infrared sensor operated flush valve with heavy duty cast escutcheon with set screw, integral screwdriver stop, vacuum breaker; 3/4 inch top spud, 11 1/2-inches high; 1 solid-ring support; 0.125gpf maximum flush.

B. SEATS

1. Type 1St.; Seat (Elongated, open front, less lid, white)

a. Manufacturers:

1) Bemis; Model 1655SSC

2) Plumbtech; Model 431SSC

3) Kohler; Model K-4666-S-C

4) Church; Model 9500SSC

5) Centoco; Model 1500 series

6) Zurn; Model Z-5955-SS-EL

b. Extra heavy weight, injection molded solid plastic, open-front, less lid, molded bumpers, external check hinges and stainless steel posts.

C. FAUCETS

1. Type 3F (Single Lever - Lavatories)

a. Manufacturers:

1) American Standard; Model 7385.050

2) Delta; Model 511LF-HGMHDF

3) Chicago; Model 420-CP

4) Encore; Model KN81-4005-CE1

5) Just; Model J-952-ADA

6) Kohler; Model K-15182-P-CP

7) Sloan; Model KN81-4005-CA1

8) Speakman; Model S-3562-LD

9) Symmons; Model S-20-0.5

10) T&S Brass; Model B-2711-VF05

11) Zurn; Model Z81000-XL

b. ASME A112.18.1M; 4-inch centerset chrome plated brass combination supply fitting with ADA compliant lever handle, aerator, 0.5 gpm; less drain.

2. Type 4bF (Electronic with standard spout - Lavatories w/ 4" centers)

a. Manufacturers:

1) American Standard; Model 6055.205 w/ 605XTMV and 605P.400

2) Delta; Model 590T1250 w/ R3070-MIXLF

3) Speakman; Model S-8711-BO w/G20-1968

4) Symmons; Model S-6080-0.5 w/S-210-CK

5) Zurn; Model Z6913-XL-TMV-CP4

6) Toto; Model TEL5DAC-10

7) Sloan; SF-2450-4 w/MIX-135

8) T&S Brass; EC-3102-VF05-TMV-013434-40

b. ASME A112.18.1M; Chrome plated brass electronic supply fitting with integral thermostatic mixing valve, Battery powered solenoid operator and infrared sensor, aerator, 0.5 gpm; cover plate; less grid drain.

3. Type 7F (8-inch spread w/ gooseneck spout - Lavatories or Sinks)

a. Manufacturers:

1) American Standard; Model 6540.170

2) Chicago; Model 785-GN-2A

3) Delta; Model 27C2942

4) Encore; Model KN84-8102-RE4

5) Just; Model J-1174-KS

6) Speakman; Model SC-3004-LD

7) Symmons; Model S-254-LWG

8) T&S Brass; Model B-2866-05

9) Zurn; Model Z831-XL-B4

b. ASME A112.18.1M; Chrome plated brass double service, 8-inch widespread gooseneck lavatory combination supply fitting rigid hi-arc gooseneck spout, aerator; 4-inch wrist handles, 1.5 gpm; less drain.

4. Type 8F (8-inch spread single lever w/spray - Sinks)

   a. Manufacturers:

      1) American Standard; Model 7074.040

      2) Delta; Model 400LF-HDF

      3) Elkay; Model LK1001-CR

      4) Encore; Model KN81-2010-TE1

      5) Just; Model J-901

      6) Kohler; Model K-15072-CP

      7) Speakman; Model S-3762-HS

      8) T&S Brass; Model B-2730

      9) Zurn; Model Z82300-XL-CP8-HS

   b. ASME A112.18.1M; Chrome plated brass double service, 8-inch widespread, single lever w/hose spray, swivel spout with aerator; 1.5 gpm.

5. Type 11F (w/ integral check stops and vacuum breaker - Mop Basin)

   a. Manufacturers:

      1) American Standard; Model 8354.112.004

      2) Delta; Model 28C8183

      3) Speakman; Model SC-5812-RCP-CK

      4) Symmons; S-2490

      5) T&S Brass; B-0665-BSTR

      6) Zurn; Model Z843M1--XL-CS

   b. ASME A112.18.1M; Rough Chrome plated brass exposed yoke wall-mount utility faucet assembly with integral stops and vacuum breaker, bucket hook, and threaded hose end, rough chrome finish.

6. Type 12F (Mop Basin Hose and Bracket)

a. Manufacturers:

1) Acorn-Terrazzo; Model KH36

2) Aquaglass AT-2452

3) Fiat 832-AA

4) Stern-Williams T-35

5) Zurn; Model Z-1996 HH

D. DRAINS

1. Type 2D (Flat grid off-set drain - Lavatories)

a. Manufacturers:

1) Dearborn; Model 760W

2) EBC; Model SG7WC

3) Kohler; Model K-13885

4) McGuire; Model 155-WC

5) Sanitary-Dash; Model R7308

6) Zurn; Model Z-8746

b. ASME A112.18.1M; 1 1/4" inch diameter chrome plated brass flat grid type drain with offset 17-gauge tailpiece.

2. Type 4D (Basket off-set drain - Sinks)

a. Manufacturers:

1) EBC; Model SB8CWC

2) Elkay; Model LKAD-35

3) Just; Model J-ADA-35

4) McGuire; Model 1151AWC

5) Zurn; Model Z-8749

b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass removable stainless steel strainer/drain assembly with offset 20-gauge tailpiece.

3. Type 6D (Flat off-set 3 1/2-inch grid - Sinks)

a. Manufacturers:

1) EBC; Model SF8WC

2) Elkay; Model LKAD18

3) Just; Model J-ADA-35-FS

4) McGuire; Model 1149WC

5) Zurn; Model Z-8750

b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass grid type strainer/drain assembly with offset 20-gauge off-set tailpiece.

4. Type 7D (Continuous Drain - 1 1/2"-inch)

a. Manufacturers:

1) EBC; Model WE-150L Series

2) Elkay; Model LK35

3) Just; Model J-53-S

4) McGuire; Model 111C16G Series

5) Zurn; Model Z-8750 Series

b. ASME A112.18.1M; 1 1/2" inch diameter chrome plated brass, 17-gauge drain assembly for double compartment sinks, complete with slip fit connections.

E. SUPPLY STOPS

1. Type SS5 (3/8"-inch, 1/4 turn; Loose Key; Lavatories/Sinks/Electric Water Coolers)

a. Manufacturers:

1) Brasscraft; Model KTSR17XC

2) Chicago; Model 1006-MMABCP

3) McGuire; Model LFHST02LK

4) Zurn; Model ZH8822-XL-LR-LK-PC

b. ASME A112.18.1M; Chrome plated brass angle heavy duty stop or ball stop, removable actuator key; supply tubing and escutcheon plate.

F. TRAPS

1. Type 1T (1 1/4"-inch Adj. 'P')

a. Manufacturers:

1) EBC; Model TA-125-CF

2) Dearborn; Model 707 DFBN

3) Kohler; Model K-9000

4) McGuire; Model 8872

5) Zurn; Model Z-8700

b. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.

2. Type 2T (1 1/2"-inch Adj. 'P')

a. Manufacturers:

1) EBC; Model TA-150-CF

2) Dearborn; Model 710 GDFBN

3) Kohler; Model K-9000

4) McGuire; Model 8912

5) Zurn; Model Z-8702

b. ASME A112.18.1M; Chrome plated cast brass, 17-gauge P-trap assembly with cast brass nuts, cleanout plug and heavy duty escutcheon.

G. CARRIERS

1. Urinals

a. Type C9

1) Manufacturers:

(a) Josam; Model 17800-63

(b) JR Smith; Model 636

(c) Mifab; Model MC-31

(d) Wade; Model W-400-M36

(e) Watts; Model CA-311-Std.

(f) Zurn; Model Z-1221

2. Lavatories
    a. Type C10 'Single'
        1) Manufacturers:
            (a) Josam; Model 17100-63
            (b) JR Smith; Model 700-M31
            (c) Mifab; Model MC-41
            (d) Wade; Model 520-36
            (e) Watts; Model CA-411-Std.
            (f) Zurn; Model Z-1231-D
    b. Type C11 'Double'
        1) Manufacturers:
            (a) Josam; Model 17105-63
            (b) JR Smith; Model 700D-M31
            (c) Mifab; Model MC-41-D
            (d) Wade; Model 520-D-M36
            (e) Watts; Model CA-411-D-Std.
            (f) Zurn; Model Z-1231-D
3. Electric Water Coolers
    a. Type C13 'Bi-Level'
        1) Manufacturers:
            (a) Josam; Model 17560-WCBL
            (b) JR Smith; Model 834LR-M31
            (c) Mifab; Model MC-33
            (d) Wade; Model 440
            (e) Watts; Model CA-431-1
            (f) Zurn; Model ZR-1225-BL

4. Carrier Notes:

    a. Carriers shall be manufactured in accordance with ASME A112.18.2 standards.

    b. All carriers shall be bolted to the floor with lag bolts.

    c. All lavatory, urinal and water cooler supports shall have heavy duty rectangular supports.

    d. Carriers shall be provided where fixture is mounted on chase wall or mechanical room wall.

H. FIXTURE INSULATION

1. Manufacturers:

    a. EBC; Model IK Series

    b. McGuire; Model 'Pro-Wrap' Series

    c. Plumberex; Model Pro Extreme Series

    d. Proflo; Model PF200 Series

    e. True-Bro; Model 'Lav Guard' Series

    f. Zurn; Model 'Trap Wrap' Series

2. Insulation assembly shall be for supply stops & tubing; drains (including off-sets) and P-traps under all ADA lavatories and counter sinks.

3. ANSI A117.1, ADA4.19.4; Fully molded, anti-bacterial flexible vinyl insulation assembly, minimum 1/8"-inch wall thickness, white in color, self-extinguishing meeting ASTM D635, and have a K-value of 1.17.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that walls and floor finishes are prepared and ready for installation of fixtures.

B. Verify that electric power is available and of the correct characteristics.

C. Confirm that millwork is constructed with adequate provision for the installation of counter top lavatories and sinks.

3.2 PREPARATION

A. Rough-in fixture piping connections in accordance with minimum sizes indicated in fixture rough-in schedule for particular fixtures.

3.3 INSTALLATION

A. Install each fixture with trap, easily removable for servicing and cleaning.

B. Provide chrome plated rigid or flexible supplies to fixtures with loose key stops, reducers, and escutcheons, as specified in Fixture Accessories.

C. Install components level and plumb.

D. Install and secure fixtures in place with wall supports and bolts.

E. Seal wall and floor mounted fixtures to wall and floor surfaces with silicon latex tile grout. Joints shall be finished smooth and flush, not depressed. Color to match fixture.

F. Solidly attach water closets to closet flange with solid brass bolts, washers and nuts. Provide wax ring sealant on closet flange. Lead flashing shall not be used.

G. Pipe runout from urinal to waste stack shall be Brass or Schedule 40 PVC piping. Copper piping shall not be used.

3.4 INTERFACE WITH WORK OF OTHER SECTIONS

A. Review millwork shop drawings. Confirm location and size of fixtures and openings before rough-in and installation.

3.5 ADJUSTING

A. Adjust stops or valves for intended water flow rate to fixtures without splashing, noise, or overflow.

3.6 CLEANING AND PROTECTION

A. Clean plumbing fixtures and equipment.

B. Do not permit use of fixtures.

3.7 SCHEDULES

A. Refer to Fixture Schedule on plans for mounting heights and piping connections.

END OF SECTION

SECTION 23 0510 - GENERAL MECHANICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions.

B. Quality Assurance Requirements and Installer Qualifications.

C. General Product Delivery and Storage.

D. Installer Warranty.

E. Submittal Procedures Supplementing Section 01 3000.

F. Mechanical Shop Drawing Requirements.

G. Operating and Maintenance Manuals.

H. Execution Requirements common to Division 23 systems.

I. Manufactured roof curbs(not specified with equipment) and equipment rails.

J. Prefabricated pipe curb.

K. HVAC Demolition.

L. Existing HVAC systems.

M. Existing HVAC Equipment.

N. Pipe Sleeves within building.

O. Pipe Sleeves in footings and foundations.

P. Space Conditioning during Construction.

Q. Equipment backboards.

R. Starting equipment and Systems-General Requirements.

S. Training Requirements.

T. Cleaning Requirements.

U. Finishing Requirements.

1.2 RELATED SECTIONS

A. Section 01 3300 - Submittal Procedures, for submittal procedures.

B. Section 01 7000 - Execution Requirements, for additional submittal and warranty requirements.

C. Section 07 8413 - Penetration Firestopping.

D. Section 9200 - Joint Sealants.

E. Section 09900 - Painting and Coatings.

1.3 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Furnish and install.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the item of equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switches by starters, the primary control device will be that ONE thermostat, time clock, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Items requiring maintenance shall be available for close approach for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling though an access point by maintenance staff safely standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Where reference is made to a Detail, the Detail shall be on the plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Design Professional shall be the instructor or shall be notified, as the case exists.

M. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

N. Flow Diagram: A single-line, two-dimension, non-scaled drawing depicting arrangement and sequence of equipment, valves, controls, thermometers, gauges, and other specialty devices in a pipe or duct system.

1.4 REGULATORY REQUIREMENTS

A. Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Permits and Codes: Refer to the General Conditions.

D. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2605 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2018 Edition, with all Georgia State Amendments, for all work involving cutting and welding.

E. HVAC: Conform to the Georgia State Minimum Standard Mechanical Code, International Mechanical Code, 2018 Edition with all Georgia State Amendments.

F. Energy: Conform to the Georgia State Energy Code for Buildings, International Energy Conservation Code, 2015 Edition, with all Georgia State Amendments.

G. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 1, 2015", and ADA.

H. Electrical: Refer to Division 26. Conform to the National Electrical Code, NFPA 70, 2023 Edition.

I. Building Code: Conform to the Georgia State Minimum Standard Building Code, International Building Code, 2018 Edition with all Georgia State Amendments.

1.5 SUBMITTALS

A. Supplementing Division 1 Administrative Requirements; the Contractor shall:

1. Identify all submittals by a cover sheet showing project name, specification section, drawing or detail number, room number, date, revision date, contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and Preparer's phone number.

2. Prepare a master list of submittal proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format of the master list shall contain a Specification Section, Section Title, Item Description, Item Status and any comment.

3. Review the submittal data and check to ensure compliance with specifications prior to submitting.

   a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Design Professional are not Change Orders. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve.

   b. The Contractor shall conform to the requirements of the Contract Documents unless a change order is issued. The Contractor shall identify on each submittal that the submittal contains no deviations or the Contractor shall identify any proposed deviations.

   c. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.

   d. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.

4. Provide a Letter from the HVAC Contractor stating that they have checked all submittals for compliance with specifications.

5. Product Data:

a. Provide data specific to the product proposed indicating capacity data, all standard and optional features to be supplied and all accessories and options available for that product.

b. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

B. Deliver submittals to the Design Professional at the business address.

C. Digital Delivery of Submittals:

1. Submittal data may be posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and a password.

2. Prepare the submittals as described above. Take steps to reduce submittal file size.

3. Do not scan in color or high resolution unless required for clarity.

4. Optimize any scans to help control file size.

5. Ensure any reproductions are legible.

6. Organize Submittal files individually by specification section with file name format as Follows; "*CSISection# - Section Title* - any further identifier required such as *control drawings*"

7. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and any Architectural Design Professional (if applicable) identified during the preconstruction phase.

8. Identify the submittal using the official project title, specification section and submitted item. i.e. Project No. G-xxx, Addition to Administrative Building-Section 230548-Vibration and Seismic Controls. Include drawing or detail number, room number, date, revision date(s), contractor and subcontractor's organization as applicable

9. Include the project manager's and manufacturers' representatives, salesman's (or a preparer who can answer questions) contact information, email and phone number.

10. Identify the submittal in the email subject line using the same information listed above.

11. Provide a submittal index.

12. Ensure any submittal posted to NBP's or other FTP site has the same identification.

13. NBP Design Professionals will not process or react to submittals which are not properly transmitted, indexed, and identified.

D. Shop Drawings:

1. General: Furnish shop drawings of each of the following systems:

a. Ductwork

2. Format and Content:

a. Shop drawings shall be complete and shall accurately show all items of equipment and material. The number of drawings, and the views contained therein, shall be as needed to show the actual and final routing, construction, and final assembly of each system.

b. All drawings shall be electronically produced in a BIM compatible format. Free-hand drawings are not acceptable.

c. All lettering shall be legible without use or aid of magnifying device. Title-block lettering shall be minimum 1/8".

d. Drawings shall be printed (or plotted) at either 24" high by 36" wide, or the same size as the Contract Drawings for the same trade, whichever is greater. Each drawing sheet shall be formatted the same as the Contract documents (i.e., border width, title block, etc.). With the exception of Isometric drawings, all other drawings shall be drawn in two-dimension and at the same scale as the Contract Drawing of the same area, or as follows, whichever is the larger scale:

e. Scale of drawings shall be as follows:

1) Floor Plans 1/8" per foot

2) Roof Plans 1/8" per foot

3) Elevations 1/4" per foot

4) Details 1/4" per foot

5) Equipment Room Layouts 1/4" per foot

6) Isometrics No scale

7) Riser Diagrams 1/4" per foot

8) Equipment Room Pad Layout 1/4" per foot

f. Three-dimensional views may be produced and used to provide supplemental information to that which is given on two dimensional drawings. Three-dimensional drawings shall be drawn from a 30-deg. perspective.

g. Each individual shop drawing sheet shall contain a single format (two-dimensional or three-dimensional).

h. In addition to the information called for in the Contract Documents provide all additional data and notations needed to show conformance with Contract Documents (i.e., air flow and volume from/to air devices).

i. For all drawings drawn in two-dimensions, all characteristics of the equipment, systems and components, shall be drawn to scale to designate actual size. Use of dimensions alone to designate width, height, length, or depth is not acceptable. Drawings shall not require that they be "scale" to determine sizes or location.

j. In the event either the project as a whole, or the specific area covered by a particular drawing, does not contain columns, floors and/or walls to which dimension reference can be made in the location of items, alternate fixed points of reference may be used.

k. Shop Drawings drawn at the same scale as the contract Drawings, shall incorporate the same floor plan or ceiling plan areas, and shall be arranged and be "broken" along the same lines as the Contract Drawings.

l. Duct and piping systems which have the following maximum width on one side shall be drawn in the following manner:

1) Drawing Scale

2) 1/4" per ft. =>4" Double-line

3) 1/4" per ft. <4" Single-line

4) Flexible Duct Single-line to diffusers

3. Ductwork Shop Drawings:

a. Background information shall be redrawn scaled versions of the Architectural floor or Reflected Ceiling Plans of the Contract Drawings and shall show all partitions, openings, and structural features. Drawings from the Contract Documents shall not be copied for use as backgrounds nor will reproducible drawings be made available from the Architect for this purpose.

b. Show fitting joints, fittings, equipment, required maintenance, removal and safe working clearances, elevations, location and sizes of access panels, net sizes (size of system less insulation), dimension from finished floor and/or overhead structure, horizontal dimension from centerline of columns, direction of flow, changes in size, changes in external covering, system material, construction classification, system name, internal liner, unique situations, equipment designation.

c. Show floor plan location of all space control and sensing devices (thermostat, humidistats, CO2 sensors etc.) complete with the designation of the piece of equipment or component which device controls. Lines drawn between the sensing

device to the controlled equipment or component, to designate their interaction, are not acceptable.

d. Sheet metal work shall be drawn using symbols and designations in accordance to the latest edition of "SMACNA" Duct Construction Standards - Metal and Flexible".

E. Tabulation of Power Wiring Requirements: Within 60 Days of the Notice to Proceed, provide a Tabulation of Power Wiring Requirements of all proposed equipment, including H.P., amps, voltage, phase and KW, tabulated on a separate sheet. A copy of the tabulation shall be transmitted independently to the Contractor, the Design Professional and to all affected trades. (Refer to Electrical Drawings for electrical provisions for equipment.)

F. Warranty: Submit the HVAC installer's warranty letter addressed to the Owner stating the correct project name and number, if applicable, the warranty period and ensure that form has the correct date of the Material Completion.

1.6 OPERATING AND MAINTENANCE MANUALS

A. Operating and Maintenance Manuals shall be prepared by the Contractor for all equipment and be submitted for review a minimum of prior to the request for Material Completion.

B. Digital delivery of Operating and Maintenance Manuals:

1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.

2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.

3. Do not scan in color or high resolution unless required for clarity.

4. Ensure any reproductions are legible.

5. Send an email to submittal@nbpengineers.com with a copy to the HVAC Design Professional and the Architectural Design Professional (if applicable) identified during the preconstruction phase.

6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.

7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.

8. Ensure the manuals posted to the FTP site has the same identification.

9. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:

1. Copies of submittals (with Design Professional's review comments and stamp), equipment and materials.

2. Manufacturer's installation, operating and maintenance instructions for each item of equipment with moving parts including recommended frequency of inspections and maintenance for one year of facility operation.

3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.

4. Control diagrams, electrical interlock diagrams, and control valve lists.

5. Copies of as-built shop drawings showing layouts and construction details.

6. Copies of Test and Balance Reports including list of instruments and description of methods employed.

1.7 QUALITY ASSURANCE

A. HVAC Installer Qualifications:

1. Wherever the word "company" or "firm" is used in these subparagraphs, it shall mean the contractor/subcontractor of record for the installations used for proficiency qualification.

2. Refer to the individual sections within this division for additional installer qualification requirements.

3. The Contractor expressly warrants that the company performing the installation of the air conditioning systems has demonstrated proficiency in the installation, start-up and adjustment of such systems by the successful performance of work of the nature specified herein on at least three commercial or institutional buildings, each containing minimum of 200 tons capacity or greater with ducted air distribution and chilled water, PTAC or wall hung units excluded.

4. The Contractor further warrants that the aforesaid subcontractor, if any, has trained personnel, instruments, tools, and equipment to perform the installation, start-up, instruction and maintenance service specified.

5. The Contractor also warrants that the aforesaid installer, if any, has been in business performing services of the nature specified herein for at least five years.

B. Testing and Balancing Qualifications: Refer to Section 23 0593.

1.8 WARRANTY

A. Refer to Section 01 7000 - Contract Closeout, for additional warranty requirements.

B. Submit manufacturers' warranties prior to final inspection. Refer to the General Conditions.

C. Correct any defective Work within a one year period after Date of Material Completion. Provide HVAC Installer's warranty letter dated the date of the Material Completion

D. Where warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start on the same date as the Contractor's warranty.

PART 2 PRODUCTS

2.1 MANUFACTURED CURBS, EQUIPMENT RAILS and OTHER ROOF ASSEMBLIES

A. Manufactured Curbs:

1. AES Manufacturing Inc.: www.aescurb.com.
2. Creative Metals .
3. Curbs Plus Inc. CPPC-*: www.curbs-plus.com.
4. Louvers and Dampers.: www.aescurb.com.
5. The Pate CompanyPC-*: www.patecurbs.com.
6. RPS AccessoriesRC-*: www.rpscurbs.com.
7. Shipman..
8. ThyCurb TC-*: www.thybar.com.

B. Manufactured Equipment Rails:

1. AES Manufacturing Inc.: www.aescurb.com.
2. Creative Metals .
3. Curbs Plus Inc. : www.curbs-plus.com.
4. Louvers and Dampers.SES-O-RC.
5. The Pate CompanyES-*: www.patecurbs.com.
6. RPS AccessoriesER-*: www.rpscurbs.com.
7. Shipman.REB.
8. ThyCurb TEMS-*: www.thybar.com.

C. Manufactured Curbs, Equipment Rails, and Other Roof Mounting Assemblies: Factory-assembled hollow sheet metal construction with fully mitered and welded corners, integral counterflashing, internal reinforcing, and top side and edges formed to shed water.

1. Sheet Metal: Hot-dip zinc coated steel sheet complying with ASTM A 653/A 653M, SS Grade 33 ; G60 coating designation; 18 gage, 0.048 inch thick.

2. Roofing Cants: Provide integral sheet metal roofing cants dimensioned to begin slope at top of roofing insulation; 1:1 slope; minimum cant height 3 inches.

3. Manufacture curb bottom and mounting flanges for installation directly on roof deck, not on insulation; match slope and configuration of roof deck.

4. Provide the layouts and configurations shown on the drawings.

D. Curbs Adjacent to Roof Openings: Provide curb on all sides of opening, with top of curb horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of curb.

2. Insulate inside curbs with 1-1/2 inch thick fiberglass insulation.

3. Height Above Finished Roof Surface: 8 inches, minimum.

4. Height Above Roof Deck: 14 inches, minimum.

E. Equipment Rails: Two-sided curbs in straight lengths, with top of rail horizontal for equipment mounting.

1. Provide preservative treated wood nailers along top of rails.

2. Height Above Finished Roof Surface: 8 inches, minimum.

3. Height Above Roof Deck: 14 inches, minimum.

2.2 PREFABRICATED PIPE CURB:

A. Manufacturers: Pate: ThyCurb; RPS Corporation.

B. 18 gauge welded galvanized roof curb with welded sealed corners, insulation, integral 3-inch x 3-inch cant and treated wood nailer.

C. Curb shall be raised cant, sized and designed for equipment support as shown with minimum 12-inch height, and top 8-inches above top of roof fill.

D. Hood: Heavy gage aluminum construction with removable top cover, faceplate and 3 sided body. Insulated aluminum mounting base isolates hood from galvanized roof curb.

PART 3 EXECUTION

3.1 EXAMINATION

A. Hazardous Materials:

1. Design Professional's Responsibility: Plans and specifications have been prepared by the A/E for the Owner without the Design Professional having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the Design Professional has not charged any fees and has not and will not advise the Owner with regard to the detection and/or removal of asbestos or hazardous waste. the Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner.

2. If the Contractor observes the existence of a friable material which must be disturbed during the course of his work, the Contractor shall promptly notify the Owner and the Design Professional. the Owner shall make all arrangements regarding testing and removal or encapsulation of asbestos material if present. the Contractor shall not perform any work pertinent to the friable material prior to receipt of special instructions from the Owner through the Design Professional.

3. "Friable Material" is any material which can be crumbled, pulverized or reduced to a powder by hand pressure when dry.

B. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Design Professional for clarification in the event of conflict.

C. All materials of systems installation exposed in hollow spaces that are used as ducts or plenums shall have a flame spread rating of 25 or less and a smoke development rating of 50 or less.

3.2 PREPARATION

A. Drawings are diagrammatic and show the general proximity of the equipment, ducts, and pipes, etc., are not to be scaled, and do not include all required changes in direction or offsets necessary in coordinating the installation of various materials either between trades or within the same trade. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:

1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.

2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.

3. All equipment requiring service shall be made accessible. Coordinate piping and ductwork installation to avoid conflict with other trades.

3.3 HVAC DEMOLITION

A. The HVAC demolition plans have been prepared to assist the Contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. the Contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

B. All existing material removed from the facility shall be the property of the Contractor, unless otherwise noted, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

C. All existing equipment removed from the facility shall be the property of the Contractor, unless otherwise noted, and shall be removed from the facility as required by the Contract provisions concerning trash removal.

D. Material and equipment which has been removed shall not be used in the new work, except as noted.

E. Where the Documents indicate an equipment item to be removed. Remove all associated material including hangers, supports, wiring, controls conduit, etc. Do not leave abandoned items.

F. Dispose of any material to be discarded in accordance with all laws and regulations.

3.4 EXISTING HVAC SYSTEMS

A. The existing mechanical equipment and systems shall remain "as-is" except as otherwise indicated or specified. Perform all work necessary to properly tie in new work with existing conditions and to adapt existing conditions to conform to the changes in the building and systems.

B. Remove exposed and accessible piping, ductwork, and other materials rendered useless due to changes or modifications. Cap outlets in piping. Blank-off or patch openings in ductwork and duct insulation. Repair insulation damaged during construction.

C. Remove concealed piping which is exposed by the removal of walls, partitions, etc., and reconnect and re-route as required to maintain system continuity.

D. Sleeves left open by removal of piping shall be cut flush with the finished slab or wall, filled with non-shrinking cement grout and/or fire rated foam flush with both sides of slab or wall to maintain slab or wall fire rating and finished to match the space finishes.

E. Openings left by removal of ductwork shall be patched matching existing construction.

F. Where existing piping, duct and/or equipment is shown on the Drawings to be reused, its identity, size, flow direction and location shall be verified prior to performing any work. Notify the Design Professional of any discrepancies.

3.5 EXISTING HVAC EQUIPMENT

A. This project makes extensive use of existing equipment.

B. The documents specify cleaning and other modifications to some of the existing equipment to be used in the modified system.

C. The documents specify the testing of this equipment recording the condition of the equipment.

D. The documents specify checking and documenting the control interlocks for the existing equipment and systems to be reused.

E. Include these activities in the overall construction schedule. Ensure that the schedule leaves time for any deficiencies to be identified and corrected before occupancy.

3.6 INSTALLATION

A. Clearance above and in front of electrical switchgear, electrical power panels or control panels shall be maintained by mechanical systems so that no mechanical ducts, pipes, vents or equipment is routed above or across the space directly above this equipment in conformance with the National Electrical Code.

B. All equipment shall be installed in accordance with manufacturers' published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturers' instructions, no work shall be performed until additional instructions are received.

C. Install and connect all appliances, equipment, and appurtenances as specified, indicated or required in accordance with the manufacturer's instructions and recommendations. Furnish and install complete auxiliary piping, water seals, valves, electric connections, and similar items, recommended by the manufacturer or as required for proper operation.

D. Equipment, valves and other items installed under this division requiring service shall be installed to be readily accessible. Refer to definitions in this section.

E. Coordinate with the Contractor and monitor the progress of the work so that other trades do not obstruct items requiring access for service.

F. After final balancing, equipment with belt drives shall have their belts operating in the mid-80% position of the adjustable sheave.

G. Provide equipment belt and coupling guards shielding the perimeter and face of all new belt drives, shafts and couplings. Provide openings opposite drive and driven shafts to permit use of revolution counter. Guards for fans shall be supported from the fan and mounting base, independent of the floor or housekeeping pad.

H. Route piping and ductwork to avoid skylights, translucent, and transparent ceilings.

I. Pipe Sleeves in Slabs, Masonry Walls and Partitions:

1. Provide sleeves in all slabs and walls/partitions unless otherwise noted.

2. Omit sleeves on cast iron pipe through slabs on grade.

3. Elevated Slabs: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a slab.

4. Masonry Partitions: Schedule 40 black steel pipe: Sleeves shall be sized to include the insulation with minimum gap around insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated masonry wall/partition.

5. Omit sleeves in openings core drilled in masonry partitions.

6. Rated Drywall Partitions: Twenty gage galvanized steel. Sleeves shall be sized to include the insulation with minimum gap around the insulation. Install, without developing a break in the pipe insulation, according to the fire sealant manufacturer's installation instructions for a U.L. Listed assembly for a rated pipe penetration through a rated drywall wall/partition.

7. Non-Rated Drywall Partitions: Omit sleeves.

J. Pipe sleeves in footings and foundation walls:

1. Schedule 40 black steel pipe.

2. Chilled water, heating water, condenser water, refrigerant, or process piping passing under a footing or through a foundation wall shall be installed in a pipe sleeve, two pipe sizes larger than the pipe passing through.

3. Sleeves in walls to spaces below grade shall be provided with 10 gauge leak plates.

K. Seal sleeves and openings in mechanical room walls, fire rated partitions, and floors above grade vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400

L. Seal sleeves and openings in exterior walls vaportight or watertight as applicable.

M. Equipment and pipe support upper attachments shall be 3" x 3" x 1/4" steel angles, minimum, spanning structural members unless noted otherwise. Provide inserts and bolts for supporting pipes and equipment from structural members.

N. Saw cut or core drill openings in existing work for the installation of the mechanical system. Patching shall be performed by the trade whose work is cut. Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

3.7 SPACE CONDITIONING DURING CONSTRUCTION

A. Coordinate with the Contractor regarding the limits of space conditions specified or requested by other trade sections.

B. Assist the Contractor in the preparation of the construction schedule and determine to what extent the project's HVAC system can be operated within the restrictions listed below to help maintain those conditions.

C. Ducted air handling systems shall not be placed into operation for testing or for temporary space conditioning until all walls in areas served by the system have been prepared for painting and the building is broom clean.

D. The building's HVAC system shall be kept clean during the entire construction process. Protect equipment, motor, ducts, pipes from dirt and debris.

E. Filters during construction:

1. Provide and maintain filters on all air handling equipment and terminal units used for space conditioning during construction.

2. Provide and maintain filters on all return air grilles once ceilings are installed when air handling equipment or terminal units are used for space conditioning during construction.

3. Provide filters with a minimum MERV rating of 8.

F. Heating Terminal units such as unit heaters, cabinet heaters and finned radiation may be used for temporary heat during construction. Clean to new condition.

3.8 EQUIPMENT BACKBOARDS

A. General: Provide wood backboards for installation of surface mounted control panels, enclosed motor controllers, variable frequency controllers, and where shown.

B. Type: 3/4-inch thick grade 1 fire retardant treated plywood supported by 3/4" x 3/4" x 1/8" aluminum angle frame attached to wall with 1/4-inch toggle bolts for hollow masonry, expansion shields for solid masonry.

C. Finish: Frame and board with two coats light gray enamel paint.

3.9 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to the Owner 's designated representative.

3.10 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. A manufacturer's service representative shall provide the instructions for each piece of equipment on system when specified in other Sections of this Division. A manufacturer's sales representative is not acceptable. (The instructor shall not be a sales person, but shall have service experience on a continuing basis and be knowledgeable about the subject equipment.)

3.11 CLEANING and PROTECTION

A. All materials, equipment and mechanical rooms shall be cleaned prior to Material Completion.

B. Wash down and scrub clean all mechanical room floors, walls, equipment bases and equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish.

D. All air handling equipment shall be cleaned internally prior to Material Completion. Clean unit casing externally and internally. Seal/replace all damaged duct liner.

E. Chipped or scraped paint shall be retouched to match original finish.

F. Clean and polish all equipment nameplates. All nameplate information shall be legible.

G. All dents and sags in ductwork and equipment casings shall be straightened.

H. All ductwork, insulation, equipment, pipe, pipe fittings and appurtenances shall be free of dust, rust and stains prior to Material Completion.

3.12 FINISHING EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint shop-primed equipment.

C. Remove unfinished louvers, grilles, covers, and access panels on mechanical and electrical components and paint separately.

D. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

E. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

F. Paint all exposed un-insulated ferrous metals, flat black.

G. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.

END OF SECTION

SECTION 23 0513 - MOTORS FOR HVAC EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single phase electric motors.

B. Three phase electric motors.

1.2 RELATED REQUIREMENTS

A. Section 23 0514 - Variable Frequency Controllers.

B. Section 26 0583 – Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ABMA STD 9 - Load Ratings and Fatigue Life for Ball Bearings; 2015.

B. IEEE 112 - IEEE Standard Test Procedure for Polyphase Induction Motors and Generators; 2004.

C. NEMA MG 1 - Motors and Generators; 2014.

D. NFPA 70 - National Electrical Code, 2023 Edition; National Fire Protection Association.

1.4 QUALITY ASSURANCE

A. Conform to NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Protect motors stored on site from weather and moisture by maintaining factory covers and suitable weather-proof covering. For extended outdoor storage, remove motors from equipment and store separately.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Baldor,Century,Lincoln,Marathon,Magnetec,Toshiba

2.2 GENERAL CONSTRUCTION AND REQUIREMENTS

A. Electrical Service:

1. Motors 1/2 HP and larger: three phase 60 Hz.

    a. 460 volt motors on 480 volt systems.

2. Refer to Electrical drawings for voltage and phase required.

B. Overload Protection: Single phase motors shall be furnished with built-in automatic reset overload protection.

C. Efficiency: Motors 1 HP and larger shall be premium efficiency motors and have minimum full load efficiencies not less than listed in the Energy Code.

D. Brake Horsepower: All motors shall have rated horsepower at least 10 percent above the indicated brake horsepower of equipment including belt losses and inlet vane losses.

E. Construction:

1. Open drip-proof type except where specifically noted otherwise.

2. Design for continuous operation in 40 degrees C environment.

3. Design for temperature rise in accordance with NEMA MG 1 limits for insulation class, service factor, and motor enclosure type.

4. All copper windings and leads.

5. Motors for belt driven equipment and base mounted pumps shall have cast iron yoke and bearing housings.

F. Visible Nameplate: Indicating motor horsepower, voltage, phase, cycles, RPM, full load amps, locked rotor amps, frame size, manufacturer's name and model number, service factor, power factor, efficiency.

G. Motors serviced by Variable Frequency Controllers:

1. Motors shall be Definite Purpose Inverter-Fed Motors complying with NEMA MG1-Part 31. Stator laminations shall be vacuum-pressure impregnated with varnish for reduction of audible motor noise.

2. Motors shall be equipped with factory installed grounding rings to electrically ground the motor shaft to prevent eddy current damage to bearings, AEGIS-SCR.

H. Wiring Terminations:

1. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70, threaded for conduit.

2. For fractional horsepower motors where connection is made directly, provide threaded conduit connection in end frame.

2.3 SINGLE PHASE POWER - PERMANENT-SPLIT CAPACITOR MOTORS

A. Starting Torque: Exceeding one fourth of full load torque.

B. Starting Current: Up to six times full load current.

C. Multiple Speed: Through tapped windings.

D. Open Drip-proof or Enclosed Air Over Enclosure: Class A (50 degrees C temperature rise) insulation, minimum 1.0 Service Factor, prelubricated sleeve or ball bearings, automatic reset overload protector.

2.4 SINGLE PHASE POWER - CAPACITOR START MOTORS

A. Starting Torque: Three times full load torque.

B. Starting Current: Less than five times full load current.

C. Pull-up Torque: Up to 350 percent of full load torque.

D. Breakdown Torque: Approximately 250 percent of full load torque.

E. Motors: Capacitor in series with starting winding; provide capacitor-start/capacitor-run motors with two capacitors in parallel with run capacitor remaining in circuit at operating speeds.

F. Drip-proof Enclosure: Class A (50 degrees C temperature rise) insulation, NEMA Service Factor, prelubricated sleeve bearings.

G. Enclosed Motors: Class A (50 degrees C temperature rise) insulation, 1.0 Service Factor, prelubricated ball bearings.

2.5 THREE PHASE POWER - SQUIRREL CAGE MOTORS

A. Starting Torque: Between 1 and 1-1/2 times full load torque.

B. Starting Current: Six times full load current.

C. Power Output, Locked Rotor Torque, Breakdown or Pull Out Torque: NEMA Design B characteristics.

D. Design, Construction, Testing, and Performance: Conform to NEMA MG 1 for Design B motors.

E. Insulation System: NEMA Class B or better.

F. Testing Procedure: In accordance with IEEE 112. Load test motors to determine free from electrical or mechanical defects in compliance with performance data.

G. Motor Frames: NEMA Standard T-Frames of steel, aluminum, or cast iron with end brackets of cast iron or aluminum with steel inserts.

H. Bearings: Grease lubricated anti-friction ball bearings with housings equipped with plugged provision for relubrication, rated for minimum ABMA STD 9, L-10 life of 20,000 hours. Calculate bearing load with NEMA minimum V-belt pulley with belt center line at end of NEMA standard shaft extension. Stamp bearing sizes on nameplate.

I. Sound Power Levels: To NEMA MG 1.

J. Nominal Efficiency: As scheduled at full load and rated voltage when tested in accordance with IEEE 112.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install securely on firm foundation. Mount ball bearing motors with shaft in any position.

C. Check line voltage and phase and ensure agreement with nameplate.

END OF SECTION

SECTION 23 0514 - VARIABLE FREQUENCY CONTROLLERS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Variable frequency controllers

1.2 RELATED SECTIONS

A. Section 23 0513 - Motors for HVAC Equipment.

B. Section 23 0553 - Identification HVAC Piping and Equipment.

C. Section 23 0994 - HVAC Sequence of Operation.

D. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 REFERENCES

A. NEMA ICS 7.1 - Safety Standards for Construction and Guide for Selection, Installation and Operation of Adjustable-Speed Drive Systems; 2006.

B. NEMA ICS 7 - Industrial Control and Systems: Adjustable Speed Drives; National Electrical Manufacturers Association, 2006.

C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum), National Electrical Manufacturers Association, 2008.

D. IEEE 519 - IEEE Recommended Practices and Requirements for Harmonic Control in Electric Power Systems; Institute of Electrical and Electronic Engineers; 1992 (R2004).

E. NFPA 70 - National Electrical Code 2023 Edition.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements, for submittal procedures.

B. Product Data: Provide catalog sheets showing voltage, controller size, ratings and size of switching and overcurrent protective devices, short circuit ratings, dimensions, and enclosure details.

C. Provide programming manual for drive. Manual shall be tabbed for items indicated in item H above.

D. Shop Drawings: Indicate front and side views of enclosures with overall dimensions and weights shown; conduit entrance locations and requirements; and nameplate legends.

E. Rating: Submittal shall specifically indicate that drive size submitted is rated for horsepower being served with drive at 40 degrees C (104 degrees F) and minimum of 4,000 hz switching frequency. Drives rated at lower frequencies are not acceptable.

F. Test Reports: Indicate field test and inspection procedures and test results.

G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

H. Manufacturer's Field Reports: Indicate start-up inspection findings.

I. Operation Data: NEMA ICS 7.1. Include instructions for starting and operating controllers, and describe operating limits that may result in hazardous or unsafe conditions.

J. Maintenance Data: NEMA ICS 7.1. Include routine preventive maintenance schedule.

K. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner's name and registered with manufacturer.

L. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories, Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle in accordance with manufacturer's written instructions. Lift only with lugs provided for the purpose. Handle carefully to avoid damage to components, enclosure, and finish.

1.7 WARRANTY

A. Provide a three year warranty to include materials only.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. ABB ACH580, AC Technology QC3000, Allen Bradley Powerflex, Danfoss VLT HVAC, Eaton DH-1 HVAC, Emerson EVC, Hitachi SJ700D, Yaskawa Z1000, Omron VT5 Series, Schneider Electric Altivar ATV, Toshiba E3 Series, Johnson Controls, Inc. Series II.

2.2 DESCRIPTION

A. Variable Frequency Controllers: Enclosed controllers suitable for operating the indicated loads, in conformance with requirements of NEMA ICS 7. Select unspecified features and options in accordance with NEMA ICS 3.1.

1. Employ microprocessor-based inverter logic isolated from power circuits.

2. Employ pulse-width-modulated inverter system providing a carrier frequency adjustable from 4,000Hz to 8,000Hz.

3. Design for ability to operate controller with motor disconnected from output.

4. Design to attempt five automatic restarts following fault condition before locking out and requiring manual restart.

B. Enclosures: NEMA 250, Type 1, suitable for equipment application in places restricted to persons employed on the premises.

C. Attic Enclosure: NEMA 250, Type 3R, suitable for equipment application in places restricted to persons employed on the premises. Provide insulated enclosure with vent fan and inlet for ducted connection and view panel.

D. Finish: Manufacturer's standard enamel.

2.3 OPERATING REQUIREMENTS

A. Rated Input Voltage: 480 volts, three phase, 60 Hertz.

B. Motor Nameplate Voltage: 460 volts, three phase, 60 Hertz.

C. Displacement Power Factor: Between 1.0 and 0.95, lagging, over entire range of operating speed and load.

D. Operating Ambient: 0 degrees C to 40 degrees C.

E. Minimum Efficiency at Full Load: 95 percent.

F. Volts Per Hertz Adjustment: Plus or minus 10 percent.

G. Current Limit Adjustment: 60 to 110 percent of rated.

H. Acceleration Rate Adjustment: .5 to 360 seconds.

I. Deceleration Rate Adjustment: 1 to 360 seconds.

J. Input Signal: 4 to 20 mA DC.

2.4 COMPONENTS

A. Display: Provide integral digital display to indicate output voltage, output frequency, and output current.

B. Status Indicators: Separate indicators for overcurrent, overvoltage, ground fault, overtemperature, and input power ON.

C. Furnish HAND-OFF-AUTOMATIC selector switch and manual speed control. Omit on fans with automatic isolation dampers.

D. Include undervoltage release.

E. Control Power Source: Integral control transformer.

F. Door Interlocks: Furnish mechanical means to prevent opening of equipment with power connected, or to disconnect power if door is opened; include means for defeating interlock by qualified persons.

G. Safety Interlocks: Furnish terminals for remote contact to inhibit starting under both manual and automatic mode.

H. Control Interlocks:

1. Furnish terminals for remote contact to allow starting in automatic mode.

2. Furnish BACNET communication device(s) to interface VFD with the BAS.

3. Provide auxiliary outputs to comply with the sequence of operation specified in Section 23 0994. Furnish programmable analog outputs(two minimum) and programmable digital outputs(three minimum).

I. Emergency Stop: Use dynamic brakes for emergency stop function.

J. Jogging: On drives serving motors of supply, return, or exhaust fans ducted into one single header duct, provide capability to bring motor up to preset, adjustable, low speed, prior to fan isolation damper opening, signal fan isolation damper to open, then continue to ramp motor up to controlled speed.

K. Disconnecting Means: Include integral circuit breaker on the line side of each controller.

L. Wiring Terminations: Match conductor materials and sizes indicated.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that surface is suitable for controller installation.

B. Do not install controller until building environment can be maintained within the service conditions required by the manufacturer.

3.2 INSTALLATION

A. Install in accordance with NEMA ICS 7.1 and manufacturer's instructions.

B. Tighten accessible connections and mechanical fasteners after placing controller.

C. Select and install overload heater elements in motor controllers to match installed motor characteristics.

D. Provide engraved plastic nameplates; refer to Section 23 0553 - Mechanical Identification, for product requirements and location.

E. Neatly type label inside each motor controller door identifying motor served, nameplate horsepower, full load amperes, code letter, service factor, and voltage/phase rating. Place in clear plastic holder.

3.3 MANUFACTURER'S FIELD SERVICES

A. Provide services of factory trained representative for minimum of one day(s) to prepare and start the controllers, calibrate the controls and inspect the installation.

B. Provide services of factory trained representative for minimum of one day(s) to instruct the Owner on operation and maintenance.

C. Controller manufacturer shall provide no less than 4 hours of on-site technical assistance to the controls contractor to assure a working hand-off of the BACnet points list. Coordinate with start-up services.

D. Provide start-up certificate in the format prescribed by the General Conditions.

3.4 ADJUSTING

A. Make final adjustments to installed controller to assure proper operation of load system. Obtain performance requirements from installer of driven loads.

3.5 DEMONSTRATION

A. Demonstrate operation of controllers in automatic and manual modes.

END OF SECTION

SECTION 23 0548 - VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Vibration isolators.

B. Roof curb isolation bases

1.2 REFERENCE STANDARDS

A. ASHRAE (HVACA) - ASHRAE Handbook - HVAC Applications; 2015.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data:

1. Provide manufacturer's product literature documenting compliance with PART 2 PRODUCTS.

C. Shop Drawings:

1. Provide schedule of vibration isolator type with location and load on each.

D. Manufacturer's Instructions: Indicate installation instructions with special procedures and setting dimensions.

1.4 QUALITY ASSURANCE

A. Comply with applicable building code.

B. Perform design and installation in accordance with applicable codes.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than three years of documented experience.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Amber Booth: www.amberbooth.com.

B. Isolation Technology, Inc.: www.isolationtech.com

C. Kinetics Noise Control, Inc: www.kineticsnoise.com.

D. Korfund Dynamics: www.thevmcgroup.com.

E. Mason Industries: www.mason-ind.com.

F. Vibration Eliminator Company, Inc; _____: www.veco-nyc.com/#sle.

G. Vibration Mounting and Control: www.vmc-kdc.com.

H. Vibro-Acoustics: http://www.vibro-acoustics.com.

2.2 PERFORMANCE REQUIREMENTS

A. General:

1. All vibration isolators, base frames and inertia bases to conform to all uniform deflection and stability requirements under all operating loads.

2. Steel springs to function without undue stress or overloading.

2.3 VIBRATION ISOLATORS

A. Non-Seismic Type:

1. Neoprene Pad Isolators:

a. Rubber or neoprene waffle pads.

1) Hardness: 30 durometer.

2) Thickness: Minimum 1/2 inch.

3) Maximum Loading: 50 psi.

4) Rib Height: Maximum 0.7 times width.

b. Configuration: Single layer.

c. Configuration: 1/2 inch thick waffle pads bonded each side of 1/4 inch thick steel plate.

2. Neoprene Rubber Mount or Hanger: Molded rubber designed for 0.4 inch deflection with threaded insert.

2.4 ROOF CURB ISOLATION BASES

A. Vibration Isolation Curbs:

1. Manufacturers.

a. Amber Booth; Model RTIR.

b. Mason Industries; Model CMAB.

c. Kinetics; Model KSR.

d. Vibration Eliminator Co.; Model AR.

e. Vibration Mounting & Control; Model AXR.

2. Construction: Weather-proof assembly with spring isolators, EPDM flexible connection and weather seals at bottom and top rails, to support rooftop equipment.

3. Design: Curb sized to fit rooftop units supplied and with isolators selected to comply with deflection requirements scheduled. Curb shall be sufficiently rigid to prevent misalignment or undue stress on machine, and to transmit design loads to isolators.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that mounting surfaces are ready to receive vibration isolation and/or seismic control components and associated attachments.

C. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION - GENERAL

A. Install in accordance with manufacturer's instructions.

B. Roof curb isolation bases:

1. Set bases for one inch clearance between roof curb and unit.

2. Adjust rooftop unit to be level.

3.3 SCHEDULE

A. Equipment Isolation Schedule.

1. Suspended fans:

a. Isolator Type: Rubber Mount or Hanger.

b. Isolator Deflection:.75 inches.

2. Packaged Roof Top Air Conditioning Units.

a. Base: Roof curb isolation base.

b. Isolator Deflection: 1.0 inches.

END OF SECTION

SECTION 23 0553 - IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Nameplates.

1.2 SUBMITTALS

A. Refer to Section 23 0510- General HVAC Requirements, for submittal procedures.

B. Product Data: Provide manufacturers catalog literature for each product required.

PART 2 PRODUCTS

2.1 NAMEPLATES

A. Description: Laminated three-layer plastic with engraved black letters on light contrasting background color.

B. Size:1/2 inch high letters unless otherwise noted.

C. Size when located on ceiling grid: 3/8 inch high letters unless otherwise noted.

PART 3 EXECUTION

3.1 PREPARATION

A. Degrease and clean surfaces to receive adhesive for identification materials.

3.2 INSTALLATION

A. Identify heat transfer equipment and packaged air conditioning units with plastic nameplates.

B. Where equipment is located above ceilings, in addition to the nameplate provided for the device; Apply a separate nameplate to ceiling grid adjacent to the panel to be removed for access for equipment located above accessible ceilings, or to access panel for non-accessible ceilings.

C. Identify control panels and major control components outside panels with plastic nameplates.

D. Identify air terminal units with plastic nameplates.

E. Tag automatic controls, instruments, and relays. Key to control schematic.

END OF SECTION

SECTION 23 0593 - TESTING, ADJUSTING AND BALANCING FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct leakage testing of 4 inch WG pressure class or higher ducts.

B. Initial testing, adjustment, and balancing of air systems.

C. Winter and Summer Seasonal testing, adjustment, and balancing of air systems.

D. Measurement of final operating condition of HVAC systems.

E. Testing of control sensors, controllers and safeties.

F. Testing, adjustment, and balancing of existing equipment and systems modified by this project.

1.2 RELATED REQUIREMENTS

A. Section 01 4000 - Quality Requirements: Employment of testing agency and payment for services.

B. Section 23 0800 - COMMISSIONING OF HVAC.

C. Section 23 3100 - HVAC Ducts and Casings - Pressure Testing Requirements.

D. Section 23 3300 - Air Duct Accessories.

1.3 REFERENCE STANDARDS

A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.

B. AABC MN-1 - National Standard for Testing and Balancing Heating, Ventilating, and Air Conditioning Systems; Associated Air Balance Council; 2002.

C. NEBB (TAB) - Procedural Standards for Testing Adjusting Balancing of Environmental Systems; 2005, Seventh Edition.

D. SMACNA HVAC Air Duct Leakage Test Manual; 2012, 2nd Edition.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Submit name of adjusting and balancing agency for approval within 30 days after Notice to Proceed.

C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.

1. Include at least the following in the plan:

    a. List of all air flow, water flow, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.

    b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.

    c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.

    d. Final test report forms to be used.

    e. Procedures for formal deficiency reports, including scope, frequency and distribution.

D. Initial Review: Submit results of testing and balancing agency's examination of documents and systems within 30 days after Notice to Proceed.

E. Initial Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.

1. Submit under provisions of Section 01 4000.

2. Submit prior to the Contractor's Request for Material Completion.

3. Submit copies of report for review prior to final acceptance of Project. Provide final copies for the Design Professional and for inclusion in operating and maintenance manuals.

4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.

5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.

6. Units of Measure: Report data in both I-P (inch-pound) and SI (metric) units.

7. Test Reports: Indicate data on AABC MN-1 forms, forms prepared following ASHRAE Std 111, or NEBB forms.

8. Include the following on the title page of each report:

    a. Name of Testing, Adjusting, and Balancing Agency.

    b. Address of Testing, Adjusting, and Balancing Agency.

    c. Telephone number of Testing, Adjusting, and Balancing Agency.

    d. Project name.

e. Project location.

f. Project the Design Professional.

g. Project Engineer.

h. Project the Contractor.

i. Report date.

F. Seasonal Reports: Submit seasonal report within 14 days of completion of seasonal adjustments. Include test reports for any equipment that could not be tested at the initial report due to season, temperature or other conditions.

1. List of deficiencies noted, adjustments made and corrective action taken.

2. Temperature of each conditioned space and dry bulb setting of controlling thermostat.

3. Temperature at all sensors in equipment, space duct or pipe and settings of controllers.

4. Date and outdoor DB and WB range during the time of the seasonal test.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL REQUIREMENTS

A. Perform total system balance in accordance with one of the following:

1. AABC (NSTSB), AABC National Standards for Total System Balance.

2. NEBB Procedural Standards for Testing Adjusting Balancing of Environmental Systems.

B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work and submit Report prior to the Final Observation of the project.

C. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.

D. TAB Agency Qualifications:

1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.

2. Certified by one of the following:

a. AABC, Associated Air Balance Council: www.aabc.com/#sle; upon completion submit AABC National Performance Guaranty.

b. NEBB, National Environmental Balancing Bureau: www.nebb.org/#sle.

3. Company shall an independent firm with no relationship with any Contractor on this Project.

E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

F. Acceptable TAB Agencies: Testing and Balancing shall be performed by one of the following firms:

1. AireBal.

2. Air Data - Macon, Inc.

3. Commissioning Services, LLC.

4. Environmental Testing Service of Columbus.

5. Georgia Balance.

6. HVAC Testing Services, Inc.

7. MDG Balancing - Dothan, AL

8. Thomas Balancing.

9. Research Air Flo Inc.

3.2 EXAMINATION

A. Review the contract documents and existing conditions for appurtenances and arrangement for balancing prior to the installation of any equipment or material. the Contractor shall notify the Design Professional of any omissions noted within 30 days of the Contractor's notice to proceed.

B. Verify that systems are complete and operable before commencing work. Ensure the following conditions:

1. Systems are started and operating in a safe and normal condition.

2. Temperature control systems are installed complete and operable.

3. Proper thermal overload protection is in place for electrical equipment.

4. All filters are clean and in place. If required, install temporary media in addition to filters.

5. Duct systems are clean of debris.

6. Fans are rotating correctly.

7. Fire and volume dampers are in place, accessible, operable and open. Report observation on test report.

8. Smoke dampers are in place, damper and operator are accessible, damper is operable, and open. Report observation on test report.

9. All dampers and operators function smoothly from shut-off to full open.

10. Air coil fins are cleaned and combed.

11. Access doors are installed at specified components are accessible, are closed and duct end caps are in place.

12. Air outlets are installed and connected.

13. Duct system leakage is minimized.

3.3 PREPARATION

A. Provide instruments required for testing, adjusting, and balancing operations. Make instruments available to the Design Professional to facilitate spot checks during testing.

B. Testing of equipment shall be simultaneous where components of a systems are connected; e.g. DX coil and condensing unit.

3.4 ADJUSTMENT TOLERANCES

A. Air Handling Systems: Adjust to within plus or minus 5 percent of design for supply systems and plus or minus 10 percent of design for return and exhaust systems.

B. Air Outlets and Inlets: Adjust total to within plus 5 percent and minus 5 percent of design to space. Adjust outlets and inlets in space to within plus or minus 10 percent of design.

C. Building Pressure: Ensure that installation tolerances result in each floor of the building being positively pressurized with respect to outside ambient pressure.

3.5 RECORDING AND ADJUSTING

A. Ensure recorded data represents actual measured or observed conditions.

B. Permanently mark settings of valves, dampers, and other adjustment devices allowing settings to be restored. Set and lock memory stops.

C. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.

D. Leave systems in proper working order, replacing belt guards, closing access doors, closing doors to electrical switch boxes, and restoring thermostats to specified settings.

3.6 AIR SYSTEM PROCEDURE

A. Pressure test ducts in accordance with SMACNA HVAC Air Duct Leakage Test Manual.

1. 4 inch WG or higher: Class 4 for rectangular ducts and Class 2 for round and oval ducts.

B. Adjust air handling and distribution systems to provide required or design supply, return, and exhaust air quantities at site altitude.

C. Make air quantity measurements in ducts by Pitot tube traverse of entire cross sectional area of duct. Close openings after measurement with permanent manufactured plugs.

D. Measure air quantities at air inlets and outlets.

E. Adjust distribution system to obtain uniform space temperatures free from objectionable drafts and noise.

F. Use volume control devices to regulate air quantities only to the extent that adjustments do not create objectionable air motion or sound levels. Effect volume control by duct internal devices such as dampers and splitters.

G. Vary total system air quantities by adjustment of fan speeds by drive sheave adjustment. Provide drive changes required to place belt in mid-position at final RPM. Vary branch air quantities by damper regulation.

H. Provide system schematic with required and actual air quantities recorded at each outlet or inlet.

I. Measure static air pressure conditions on air supply units, including pressure drops at all components including filters and fans, and total pressure across the fan. Make allowances for 50 percent loading of filters.

J. Adjust outside air automatic dampers, outside air, return air, and exhaust dampers for design conditions. Adjust operators on outside air dampers to ensure tight seal when shut.

K. Measure temperature conditions across outside air, return air, and exhaust dampers to check leakage.

L. The differential at the time of balance between the outside and return air streams shall be 15 degrees F, minimum, when the outside air quantities are established by temperature differential.

M. Where modulating dampers are provided, take measurements and balance at extreme conditions. Balance variable volume systems at maximum air flow rate, full cooling, and at minimum air flow rate, full heating.

N. Measure building static pressure and adjust supply, return, and exhaust air systems to provide required relationship between each to maintain positive building pressure near the building entries under all operational sequences.

3.7 WATER SYSTEM PROCEDURE

A. Adjust water systems to provide required or design quantities.

B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.

C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.

D. Effect system balance with automatic control valves fully open to heat transfer elements.

E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

F. Where available pump capacity is less than total flow requirements or individual system parts, full flow in one part may be simulated by temporary restriction of flow to other parts.

3.8 CONTROL SYSTEM PROCEDURE

A. Low Limit Thermostats, Fire Thermostats, Smoke Detectors and other Safety devices: Test and verify operation. Record setpoint.

B. Sequence of Operation: Operate systems thru specified Sequence and confirm system function.

C. Thermostats, Input/Output sensors and Controls: Measure temperature or flow at device and record measurement and setting of controller.

D. Airflow Measuring Stations: Calibrate flow measuring station. Confirm accuracy by testing thru a four point operating range.

E. Humidistats, Humidity Input/Output sensors and Controls: Measure temperature and relative humidity at device and record measurement and setting of controller.

3.9 BALANCE UNDER SEASONAL OPERATING CONDITIONS

A. After the initial balance has been completed, reviewed and accepted; the contractor shall balance and adjust the system under seasonal operating conditions by performing operational tests over a minimum period of eight hours under both cooling and heating conditions.

B. These tests shall be performed only after each piece of equipment has been individually tested, and is verified to be in correct operating condition, and shall be made at times when outdoor dry bulb temperatures are above 85 F for cooling, or below 50 F for heating.

C. When test is run during the cooling cycle the building must be occupied, and all lights shall be turned on for a minimum of six (6) hours. Doors to all spaces shall be closed and all space thermostats set at its normal setpoint.

D. Purpose: Prove correctness of installation; prove functioning of capacity and safety controls; prove calibration of operating controls; and prove stability of operation under actual loading conditions.

3.10 SCOPE

A. Test, adjust, and balance the following:

1. Packaged Roof Top Heating/Cooling Units.
2. Terminal Heat Transfer Units.
3. Fans, Powered Ventilators and Exhausters
4. Air Terminal Units.
5. Airflow Measuring Stations
6. Air Inlets and Outlets.

3.11 MINIMUM DATA TO BE REPORTED

A. Electric Motors:

1. Manufacturer.
2. Model/Frame.
3. HP/BHP.
4. Phase, voltage, amperage; nameplate, actual, no load.
5. RPM.
6. Service factor.
7. Starter size, rating, heater elements.
8. Sheave Make/Size/Bore.

B. V-Belt Drives:

1. Identification/location.
2. Required driven RPM.
3. Driven sheave, diameter and RPM.
4. Belt, size and quantity.
5. Motor sheave diameter and RPM.
6. Center to center distance, maximum, minimum, and actual.

C. Cooling coil casings: Test the air handling casing(s) downstream of the cooling coils to determine leakage into this section(s) is less than 3.5% of design maximum system air quantity. This infiltration shall be determined as follows:

1. Measure cooling coil leaving air temperature.
2. Measure fan entering air temperature
3. Measure duct supply air fan motor amperage on all legs.
4. At time of measurement, the temperature difference between inside and outside of casing shall be at least 20 degrees .
5. Calculate infiltration percentage and report all values measured for this test

D. Cooling Coils:

1. Identification/number.
2. Location.
3. Service.
4. Manufacturer.
5. Air flow, design and actual.
6. Entering air DB temperature, design and actual.
7. Entering air WB temperature, design and actual.
8. Leaving air DB temperature, design and actual.
9. Leaving air WB temperature, design and actual.
10. Saturated suction temperature, design and actual.
11. Air pressure drop, design and actual.

E. Air Moving Equipment:

1. Location.
2. Manufacturer.
3. Model number.
4. Serial number.
5. Arrangement/Class/Discharge.
6. Air flow, specified and actual.

7. Return air flow, specified and actual.
8. Outside air flow, specified and actual.
9. Total static pressure (total external), specified and actual.
10. Inlet pressure.
11. Discharge pressure.
12. Sheave Make/Size/Bore.
13. Number of Belts/Make/Size.
14. Fan RPM.
15. Describe filter condition.
16. Plot actual fan operating point on fan curve chart.

F. Return Air/Outside Air:

1. Identification/location.
2. Design air flow.
3. Actual air flow.
4. Design return air flow.
5. Actual return air flow.
6. Design outside air flow.
7. Actual outside air flow.
8. Return air temperature.
9. Outside air temperature.
10. Required mixed air temperature.
11. Actual mixed air temperature.
12. Design outside/return air ratio.
13. Actual outside/return air ratio.

G. Exhaust Fans:

1. Location.

2. Manufacturer.
3. Model number.
4. Serial number.
5. Air flow, specified and actual.
6. Total static pressure (total external), specified and actual.
7. Inlet pressure.
8. Discharge pressure.
9. Sheave Make/Size/Bore.
10. Number of Belts/Make/Size.
11. Fan RPM.
12. Plot actual operating point on pump curve chart.

H. Duct Traverses:

1. System zone/branch.
2. Duct size.
3. Area.
4. Design velocity.
5. Design air flow.
6. Test velocity.
7. Test air flow.
8. Duct static pressure.
9. Air temperature.
10. Air correction factor.

I. Duct Leak Tests:

1. Description of ductwork under test.
2. Duct design operating pressure.
3. Duct design test static pressure.

4. Duct capacity, air flow.
5. Maximum allowable leakage duct capacity times leak factor.
6. Test apparatus:
    a. Blower.
    b. Orifice, tube size.
    c. Orifice size.
    d. Calibrated.
7. Test static pressure.
8. Test orifice differential pressure.
9. Leakage.

J. Airflow Measuring Stations:
1. Identification/location.
2. System.
3. Size.
4. Area.
5. Design velocity.
6. Design air flow.
7. Test velocity.
8. Test air flow.

K. Air Terminal Unit Data:
1. Manufacturer.
2. Type, constant, variable, single, dual duct.
3. Identification/number.
4. Location.
5. Model number.
6. Size.

7. Minimum static pressure.
8. Minimum design air flow.
9. Maximum design air flow.
10. Maximum actual air flow.
11. Inlet static pressure at 1 foot upstream of unit inlet
12. Fan-powered units:
    a. Supply air temperature leaving FPU when air valve is at maximum design flow.
    b. Coincident (with LAT measurement) entering air temperature to air valve.
    c. Fan static pressure - discharge of unit.
    d. Fan speed setting

L. Air Distribution Tests:

1. Air terminal number.
2. Room number/location.
3. Terminal type.
4. Terminal size.
5. Area factor.
6. Design velocity.
7. Design air flow.
8. Test (final) velocity.
9. Test (final) air flow.
10. Percent of design air flow.
11. Relative position of balancing damper

M. Space Temperature and Humidity:

1. Temperature and humidity (whether controlled or not) of each conditioned space
2. Setpoint of each controlling thermostat or humidity sensing device.

END OF SECTION

SECTION 23 0713 - DUCT INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct insulation

B. Duct Liner

1.2 REFERENCE STANDARDS

A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2010.

B. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013.

C. ASTM C916 - Standard Specification for Adhesives for Duct Thermal Insulation; 2014.

D. ASTM C1071 - Standard Specification for Fibrous Glass Duct Lining Insulation (Thermal and Sound Absorbing Material); 2012.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2014.

G. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

H. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

1.3 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements, for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.4 QUALITY ASSURANCE

A. Applicator Qualifications: Company specializing in performing the type of work specified in this section, with minimum three years of experience and approved by manufacturer.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.

B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.6 FIELD CONDITIONS

A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.

B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 GLASS FIBER, FLEXIBLE

A. Manufacturer:

1. Johns Manville: www.jm.com.

2. Owens Corning Corporation; SOFTR: www.ocbuildingspec.com.

3. CertainTeed Corporation: www.certainteed.com.

B. Insulation: ASTM C 553; flexible, noncombustible blanket.

1. 'K' value: 0.27 at 75 degrees F, when tested in accordance with ASTM C 518.

2. Maximum Service Temperature: 250 degrees F.

3. Maximum Water Vapor Sorption: 5.0 percent by weight.

4. Density: 1.0 lb./cu ft.

C. Vapor Barrier Jacket:

1. Kraft paper with glass fiber yarn and bonded to aluminized film.

2. Moisture Vapor Permeability: 0.029 ng/Pa s m (0.02 perm inch), when tested in accordance with ASTM E96/E96M.

3. Secure with pressure sensitive tape.

D. Vapor Barrier Tape:

1. Kraft paper reinforced with glass fiber yarn and bonded to aluminized film, with pressure sensitive rubber based adhesive.

E. Tie Wire: Annealed stainless steel, 16 gage.

2.3 DUCT LINER - GLASS FIBER

A. Manufacturers: Certainteed ToughGard-R, Owens-Corning QuietR, JohnsManville Permacote Linacoustic RC-HP.

B. Insulation: Incombustible glass fiber complying with ASTM C 1071; flexible blanket; impregnated surface and edges coated with acrylic polymer shown to be fungus and bacteria resistant by testing to ASTM G 21.

1. Apparent Thermal Conductivity: Maximum of 0.31 at 75 degrees F.

2. Service Temperature: Up to 250 degrees F.

3. Rated Velocity on Coated Air Side for Air Erosion: 5,000 fpm, minimum.

4. Density: 1.5 pcf.

5. Minimum Noise Reduction Coefficients:

a. 1 inch Thickness: 0.70

b. 2 inch Thickness: 0.95

C. Adhesive: Waterproof, fire-retardant type, ASTM C916.

D. Liner Fasteners: Galvanized steel, welded with press-on head.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that ducts have been tested before applying insulation materials.

B. Verify that surfaces are clean, foreign material removed, and dry.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Provide insulation with vapor barrier jackets.

D. Seal all joints, mechanical fastener penetrations, and vapor barrier penetrations with Vapor Barrier Tape

E. Continue insulation through walls, sleeves, hangers, and other duct penetrations.

F. Insulate entire system including fittings, joints, flanges, fire dampers, flexible connections, duct lined with duct liner, heating coil return bends at terminal units, and expansion joints.

G. Fiber Glass, Flexible:

1. Do not pull insulation tight around ducts.

2. Lap transverse joints 2 inch, minimum and secure with staples 18 inches on center.

3. Wrap insulation with Tie Wire 18 inches on center, maximum.

4. Install mechanical fasteners not more than 18 inches on center on ducts over 24 inches wide.

5. Provide 24 inch length, minimum, of rigid glass fiber insulation on bottom of ducts supported from trapeze hangers.

H. Weld mechanical fasteners to duct. No glue or stick on allowed.

I. Duct Accessories, Duct Mounted Meters and Gages Instruments and Duct Mounted Instrumentation and Other Control Devices:

1. In conditioned spaces devices shall be left exposed and/or accessible above the insulation vapor barrier jacket for access. Seal to vapor barrier jacket.

2. In non-conditioned spaces devices shall be insulated within the insulation vapor barrier jacket with the insulation and jacket arranged to provide access.

3. Accessible devices to include:

a. Duct mounted Instrumentation,

b. Airflow Measuring Station pressure ports,

c. Input/Output Sensors,

d. Duct access door handles,

e. Volume Control damper handles(MVD),

4. Damper operators shall be left exposed and/or accessible above the insulation vapor barrier jacket for access. Seal to vapor barrier jacket.

J. Duct Liner Locations:

1. Line supply and return ducts where noted on drawings with 1 inch liner.

2. Provide 2 inch liner at field fabricated mixing plenums.

3. Do not install liner in duct within six feet downstream of a cooling coil or outside air intake.

K. Duct and Plenum Liner Application: (Glass Fiber Liner)

1. Install liner in accordance with manufacturer's Published Installation Instructions and SMACNA Installation Standards including Figure No. 7-11 and 7-12.

2. Adhere insulation with adhesive for 90 percent coverage.

3. Secure insulation with mechanical liner fasteners, type 3 or 4 located in accordance with SMACNA Figure 7-11. Refer to SMACNA (DCS) Standards for spacing.

4. Install with longitudinal and transverse joints under compression.

5. Seal and smooth all longitudinal and transverse joints, field cuts exposed edges and any minor surface damage with edge coat.

6. Seal liner surface penetrations with edge coat.

7. Provide 26 gauge metal nosing on leading edge at fan discharges and at any interval of lined duct proceeded by unlined duct.

8. Terminate liner at duct mounted accessories such as turning vanes and dampers. Provide sheet metal "hat" section build out in accordance with SMACNA Figure 7-13.

9. Duct dimensions indicated are net metal inside dimensions required for air flow. Do not Increase duct size to allow for insulation thickness.

10. Provide protection for surfaces that may be subject to damage by tradesmen installing electrical, controls or other work.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.4 SCHEDULES

A. Plenums:

1. Glass Fiber, Flexible; 2 inch thick.

B. Supply Ducts:

1. Concealed and exposed in Mechanical Rooms and Non Conditioned Interior Spaces: Glass Fiber, Flexible; 2 inch thick.

2. Exposed Supply Ducts in Conditioned Spaces: Do Not Insulate.

3. Tops of Ceiling diffusers: Glass Fiber, Flexible; 2 inch thick.

C. Return Ducts:

1. Return ducts in Non-Conditioned Space: Glass Fiber, Flexible; 2 inch thick.

2. Return Ducts in Conditioned Space or Return Air Plenum: Do Not Insulate.

END OF SECTION

SECTION 23 0719 - HVAC PIPING INSULATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Piping insulation.

1.2 REFERENCE STANDARDS

A. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2014.

B. ASTM C585 - Standard Practice for Inner and Outer Diameters of Thermal Insulation for Nominal Sizes of Pipe and Tubing; 2010.

C. ASTM C591 - Standard Specification for Unfaced Preformed Rigid Cellular Polyisocyanurate Thermal Insulation; 2015.

D. ASTM C 1126 - Standard Specification for Faced or Unfaced Rigid Cellular Phenolic Thermal Insulation; 2009.

E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

F. NFPA 255 - Standard Method of Test of Surface Burning Characteristics of Building Materials; National Fire Protection Association 2007.

G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.3 SUBMITTALS

A. See Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.4 QUALITY ASSURANCE

A. All insulation, mastics, coatings, sealants, and adhesives shall be certified by the manufacturer to be Asbestos-free.

B. Applicator Qualifications: Company specializing in performing the type of work specified in this section with minimum Three years of experience.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

PART 2 PRODUCTS

2.1 REGULATORY REQUIREMENTS

A. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E 84, NFPA 255, or UL 723.

2.2 FLEXIBLE ELASTOMERIC CELLULAR INSULATION

A. Manufacturer:

1. Aeroflex USA, Inc.; Aerocel: www.aeroflexusa.com/#sle.

2. Armacell LLC: www.armacell.us/#sle.

3. K-Flex USA LLC; Insul-Tube: www.kflexusa.com/#sle.

B. Insulation: Preformed flexible closed-cell elastomeric rubber insulation complying with ASTM C 534 Grade 1; use molded tubular material. Split tube installation is prohibited.

1. 'K' ('Ksi') value: 0.25 at 75 degrees F (0.04 at 24 degrees C).

2. Maximum Moisture Absorption: < 1.0 percent (pipe) by volume, when tested in accordance with ASTM C 209.

3. Water Vapor Permeability: 0.05 perm-inches, when tested in accordance with ASTM E 96.

4. Minimum Service Temperature: Minus 40 degrees F.

5. Maximum Service Temperature: 220 degrees F.

6. Connection: Waterproof vapor barrier adhesive.

C. Elastomeric Foam Adhesive: Air dried, contact adhesive, compatible with insulation.

2.3 STAPLES, BANDS, AND WIRES

A. Staples shall be outward clinching type of type 304 or 316 stainless steel, or monel.

B. Bands shall be galvanized steel, aluminum, brass, or nickel copper alloy, of 3/4 inch nominal width. The band thickness exclusive of coating shall be not less than 30 gauge for steel and nickel copper alloy.

C. Wire shall be 18-gauge stainless steel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that piping has been tested before applying insulation materials.

B. Verify that surfaces are clean and dry, with foreign material removed.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install in accordance with NAIMA National Insulation Standards.

C. Exposed Piping: Locate insulation and cover seams in least visible locations. Exterior of insulation shall be uniform in appearance.

D. Insulation jacket shall fit snug to insulation.

E. Valves and fittings:

1. Insulate pipe and all valves and fittings including valve bonnets on chilled water piping. Leave only valve stems, open ends of wells and gauge cocks exposed.

2. All Other Piping: Insulate pipe and fittings, but omit insulation on unions and valves. Taper insulation ends and cover with jacket material.

F. Saddles:

1. Provide galvanized steel saddles at each point where pipe insulation passes through a hanger or rests on a support.

2. Saddles shall be 180 arc for horizontal piping, 360 arch for vertical piping.

3. Center saddle on pipe hanger.

4. Length and gauge of saddle shall be as follows:

a. 2 inch pipe size and smaller: 18 Gauge saddle, 8 inch long, minimum.

b. 2-1/2 & 3 inch pipe size: 18 Gauge saddle, 12 inch long, minimum.

c. 4 inch pipe size: 16 Gauge saddle, 16 inch long, minimum.

d. 6 inch pipe size and larger: 16 Gauge saddle, 24 inch long, minimum.

3.3 CLEANING

A. Clean adjacent surfaces, valves, valve handles, etc. of jacketing materials.

3.4 SCHEDULES

A. DX Cooling Systems:

1. Refrigerant Piping: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

B. Condensate Drains from Cooling Coils: 3/4 inch thick preformed flexible elastomeric cellular rubber insulation.

END OF SECTION

SECTION 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Airflow measuring stations.

B. Control panels.

C. Thermostats.

D. Automatic dampers.

E. Damper operators.

F. Input/Output Sensors.

G. Miscellaneous accessories.

1.2 RELATED REQUIREMENTS

A. Section 23 3300 - Air Duct Accessories: Installation of automatic dampers.

B. Section 26 0519 - Low-Voltage Electrical Power and Conductors & Cables.

1.3 REFERENCE STANDARDS

A. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); National Electrical Manufacturers Association; 2014.

B. NFPA 90A - Standard for the Installation of Air-Conditioning and Ventilating Systems; 2015.

1.4 SUBMITTALS

A. Refer to Section 23 0510- General HVAC Requirements for submittal procedures.

B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.

C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.

D. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

1.5 QUALITY ASSURANCE

A. Installer Qualifications: Company specializing in performing the work of this section with minimum 5 years' experience employed directly by the digital equipment manufacturer.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 EQUIPMENT - GENERAL

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.2 AIRFLOW MEASURING STATIONS (AFMS):

A. Airflow Measuring Stations (AFMS):

1. Manufacturer: Tek-Air Systems - Vortek VT series; IAQ 2000 for OA

2. Provide airflow/temperature measurement devices for measurement of outside air and other locations where shown on the plans.

3. Vortek-VT5000:

a. Airflow measuring devices shall be the vortex shedding type continuously monitoring the airflow volume of the duct served and transmitting an electronic signal linear to the airflow volume.

b. Devices shall be of the insertion type, capable of measuring velocity over the full range of 400 to 7000 FPM.

c. Sensors shall be mounted on aluminum support bars, with aluminum and ABS sensors.

d. Velocity sensors shall not be effected by dust, pressure, temperature, or humidity and shall not require calibration.

e. Stations shall be AMCA certified, measuring airflow rates within an accuracy of +/- 2% of volumetric flow rate without the use of correction factors. Turndown capability shall be minimum 15:1.

4. IAQ 2000:

a. Install in outside air intake openings or ducts and measure outside air from specified minimum up to 100 percent outside air.

b. Airflow measuring devices shall be probe shall be "golf ball pattern" differential pressure type probe complete with auto-zero valve and ambient temperature

sensor. Transducer shall be mounted in a sealed NEMA 4 enclosure, suitable for mounting in the outdoor air plenum. Weather tight connection cables with weatherproof connectors shall be provided. Cable shall be plenum rated.

c. Monitor airflow within accuracy of +/-5 percent of reading over the range of 1000 to 200 FPM and +/-10% over the range of 200 to 75 FPM.

5. Transmitters:

a. Each station shall be provided with a single microprocessor- based transmitter operating on 24 VAC with connecting cables. Transmitter shall have an LCD display for air flow and temperature.

b. Each transmitter shall be capable of communicating with the BAS controls system using a linear analog output signal, 4-20mA.

B. Airflow Measuring Stations (AFMS):

1. Manufacturers: JCI AD-1252, Ebtron-GTX Series, Air Monitor Electra-Flo.

2. Provide airflow/temperature measurement devices for measurement of outside air where shown on the plans. Duct mounted sensors shall be fabricated of aluminum alloy tubing with 304 stainless steel mounting brackets. The equipment submittal shall indicate the number of sensors for each airflow measuring station based on duct arrangement and location.

3. Each station shall consist of one or more multi-point measuring probes using thermal dispersion technology, and a single microprocessor- based transmitter.

4. The operating airflow range shall be 0-5000 FPM. Each independent airflow sensor shall have a laboratory accuracy of +/-2% of reading over the entire operating airflow range.

5. Transmitters:

a. Each station shall be provided with a single microprocessor- based transmitter operating on 24 VAC with connecting cables. Transmitter shall have an LCD display for air flow and temperature.

b. Each transmitter shall be capable of communicating with the BAS controls system using a linear analog output signal, 4-20mA.

2.3 CONTROL PANELS

A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.

B. NEMA 250, general purpose utility enclosures with hinged, lockable face panel.

C. Finish: Baked enamel factory finish.

D. Provide common keying for all panels with two keys per control panel.

E. Nameplates:

1. Use device identification and number from control drawings.

2. Identify panel with permanent label mounted on panel face. Nameplate shall be bakelite with white letters, 3/8 inch minimum height.

3. Identify all panel mounted devices with permanent label mounted adjacent to device. Nameplates shall be bakelite with white letters, 1/8 inch minimum height.

F. Door mounted devices: Refer to the Sequence of Operation for devices specified to be door mounted.

G. Wiring:

1. Power supply of capacity required with disconnect switch, surge protection, fuse holder with fuses or circuit breaker, 120 VAC service receptacle.

2. Conductors color coded with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

3. Connections and junctions to terminal strips and devices only.

4. Route wiring parallel to cabinet side in wiring troughs or laced with nylon ties.

5. Wiring and devices that derive power from other sources shall be located in a separate compartment and be provide with separate terminal strips.

6. Cover all line voltage terminations in panel.

H. Indicator lights: 24 VAC light emitting diode. 100,000 hour lamp life. Provide single "Press-To-Test" button for all lights in panel.

2.4 CONTROL DAMPERS

A. Manufacturers: Arrow 515/516 SAF, Johnson VD-1300, Ruskin CD-60, National Controlled Air SCD-AF, TAMCO-1000, Greenheck VCD-33.

B. Frames: Galvanized steel, welded or riveted with corner reinforcement, minimum 16 gage.

C. Blades: Galvanized steel, double thickness airfoil, maximum blade size 8 inches wide, 48 inches long, minimum 16 gage, attached to minimum 1/2 inch shafts with set screws.

D. Blade Seals: Synthetic elastomeric mechanically attached, field replaceable.

E. Jamb Seals: Spring stainless steel.

F. Shaft Bearings: Oil impregnated sintered bronze.

G. Linkage and linkage Bearings: Blade linkage outside of airstream with Oil impregnated sintered bronze bearings.

H. Leakage: Class 1; 8.0 CFM/Sq.FT.inch maximum at 4-inch W.G. pressure difference.

I. Pressure Drop: Less than 0.10 inches W.G. based on fully open 48" x 48" damper and an approach velocity of 2000 FPM.

J. Maximum Pressure Differential: 6 inches wg.

K. Temperature Limits: -40 to 200 degrees F.

2.5 DAMPER OPERATORS

A. General: Provide smooth proportional control with sufficient power for air velocities 20 percent greater than maximum design velocity and to provide tight seal against maximum system pressures. Provide spring return for two position control and for fail safe operation.

1. Provide sufficient number of operators to achieve unrestricted movement throughout damper range.

2. Provide one operator for maximum 36 sq ft damper section.

B. Electric Operators:

1. Manufacturers: Belimo AF24, TFB24, or NF24, Neptune, Siemens, Johnson Controls.

2. Spring return, adjustable stroke motor having oil immersed gear train, with auxiliary end switch.

3. 24 VAC reversible motor with Class F insulation or better with drive mechanism in enclosure, 10VA maximum..

4. Feedback Signal: Independent of input signal providing feedback of true position indication.

5. Enclosure: Aluminum cover and base, NEMA-2, IP 54, coupling direct to damper.

6. Provide all corrosion resistant (non-ferrous) components, fasteners and mounting devices and connections.

7. Unit shall be prewired. Provide a conduit fitting and a three foot long appliance cord.

8. Status display: Visual indicator to display damper position through full range of travel.

9. External built-in travel limit switch to reverse direction.

10. Manual override with hex operator.

2.6 INPUT/OUTPUT SENSORS

A. Temperature Sensors:

1. Platinum resistance temperature detectors with resistance tolerance of plus or minus 0.1 percent at 70 degrees F, interchangeability less than plus or minus 0.2 percent, time constant of 13 seconds maximum for fluids and 200 seconds maximum for air.

2. Measuring current maximum 5 mA with maximum self-heat of 0.031 degrees F/mW in fluids and 0.014 degrees F/mW in air.

3. Provide 3 lead wires and shield for input bridge circuit.

4. Use insertion elements in ducts not affected by temperature stratification and smaller than 9 square feet. Use averaging elements where larger or prone to stratification. Sensor length 8 feet or 16 feet as required.

5. Use sensor holder with mounting plate and conduit enclosure with cover plate for elements mounted on ducts. Provide extension between plate and enclosure on insulated ducts.

6. Insertion elements for liquids shall be with brass socket with minimum insertion length of 2-1/2 inches. Provide lagging extensions on insulated pipes.

7. Room digital thermostats: Sensor with setpoint adjustment marked warmer/cooler, built-in override button, terminal block wiring connection and I/O communication port for portable monitoring device. Locking cover. blank cover in all public spaces

8. Outside air sensors: Watertight inlet fitting, shielded from direct rays of sun.

B. Humidity Sensors:

1. Manufacturer: Vaisala HMD/W60/70; NIST certified.

2. Industrial quality, bulk polymer type, with replaceable element and an accuracy of +2% RH in the range of 20-90% when used for control applications. The sensors should be capable of calibration. Saturation shall not alter calibration. Space humidity sensors should have the same appearance as space temperature sensors.

3. Elements: Accurate within +/-2% percent full range with linear output.

4. Duct and Outside Air Sensors: With element guard and mounting plate, range of 0 - 100 percent relative humidity.

C. Static and Differential Pressure Sensors:

1. Manufacturer: Setra Sensing Solutions, Veris.

2. Designed for media sensed and for static or differential pressure measurement, as appropriate. The sensor should be capable of withstanding an over range pressure limit of 300% of the normal expected value. Sensor should incorporate a transducer with non-interacting zero and span adjustments. The zero shall be continuously adjustable on outputs.

3. Unidirectional with ranges adjustable from 0-125 percent of maximum expected full pressure or full flow differential pressure.

4. Temperature compensate with typical thermal error or 0.06 percent of full scale in temperature range of 40 to 100 degrees F.

5. Accuracy: One percent of full scale with repeatability 0.3 percent.

6. Output: 4-20mA signal, 2 wire.

7. Hydronic Systems - Provide high and low isolation valves, and parallel pressure gage piped to read high/low pressure independently.

8. Low and High Static Pressure Limit - provide hard wired safety function interlock to equipment starter. Provide additional dry contact for monitoring by the DDC System.

9. Building Pressure Sensors: Provide device and installation features to reduce and minimize any performance impact related to wind effect.

D. Equipment Operation Sensors:

1. Status Inputs for Electric Motors:

a. U.L. Listed current sensing relay with split core current transformer, 1 amp @ 30 VAC adjustable setpoint output switch, adjustable mounting bracket, power and trip LED indication.

b. Constant speed fans and pumps: Output switch trip setpoint at 10% below the normal motor operating speed and current draw.

c. Variable speed fans and pumps: Output switch trip setpoint at 5% below the lowest motor operating speed and current draw as determined in the commissioning process, typically 20%.

d. Product: Veris Industries Hawkeye H-900, Kele D-150, Veris Industries.

E. Damper Position Indication: Potentiometer mounted in enclosure with adjustable crank arm assembly connected to damper to transmit 0 - 100 percent damper travel.

2.7 SWITCHING DEVICES

A. Electric Relays:

1. Heavy duty, isolated, cabinet mounted, blade plug-in type with base.

2. Rating: 10 amps, minimum at 125 VAC:

2.8 THERMOSTATS

A. Electric Low Limit Duct Thermostat(Freezestat):

1. Refer to sequence of operation for any auxiliary switches required.

2. Bulb length: Minimum 20 feet.

3. Provide one thermostat for every 20 sq ft of coil surface.

4. Provide 1 linear foot of element for each square foot of coil area installed in a horizontal sine curve and supported independently from the coil by stainless steel bands or multibulb holders. Provide 0.375" hard copper rails for support of elements, both top and bottom.

5. Setpoint range: 30-40 degrees F, minimum. Factory setpoint of 34 degrees F.

B. Fire Thermostats(Firestats):

1. UL labeled, factory set in accordance with NFPA 90A.

2. Normally closed contacts, adjustable setpoint, manual reset, dust cover and adjustable duct mounting flange with extension for mounting on insulated duct.

3. Set point range: 100-250 Degree F.

4. Initial Setpoint: 195 Degree F

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that systems are ready to receive work.

C. Beginning of installation means installer accepts existing conditions.

D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

F. Ensure installation of components is complementary to installation of similar components.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate all control devices except for sensors and devices integral to equipment within control panels, unless otherwise noted.

C. Install control devices in a readily accessible location. Refer to definitions in Section 23 0510.

D. Coordinate with the Contractor and monitor the work so that other trades do not obstruct control devices or other items requiring access for service.

E. Device mounting:

1. All devices shall be permanently mounted and secured in place.

2. Mount control panels on backboards adjacent to associated equipment on vibration free walls or free standing angle iron supports. Refer to Section 23 0510 for backboards.

3. Panel mounted controls: Secure to panel backs with non-ferrous sheet metal screws.

4. Gypsum Board and Plaster walls: Moly-bolt type anchor. No adhesive or plastic insert anchors.

5. Concrete Walls: Non-ferrous screws and expansion shields.

6. Concrete masonry units: Mount to recessed box or secure with moly-bolt type anchor.

7. Provide accessory wall adapter plates where required to cover block or wall opening edges.

8. Pipe and duct mounted devices: Secure to well or mounting flange. Provide well and flange extensions on insulated duct and pipe to clear insulation thickness.

9. Mount dampers with blades horizontal.

F. Identification:

1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.

a. Include sensor type, normal setpoints information on nameplate.

b. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.

2. Color code conductors with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

G. Electrical wiring:

1. All control and interlock wiring shall be provided under this section.

2. No splices between field devices and control panels are permitted.

3. All Wiring materials and methods shall comply with Division 26 except:

a. Minimum wire size shall be 14 AWG(copper) for line voltages.

b. Minimum wire size shall be 18 AWG(copper) for signal.

4. Fire Alarm System Interface: Signal for fan shutdown shall be obtained from fire alarm output relay located in mechanical room adjacent to the starter/motor control center, unless otherwise noted.

5. Electric Operators:

a. Power wiring for controls provided under Division 26 is shown on the Electrical Drawings. Provide conduit, conductors, power supplies and transformers as required for power to operate electric operators.

b. The feedback signal for each separately controlled damper operator shall be wired back to a terminal strip in the control panel for trouble-shooting purposes.

H. Airflow Measuring Stations:

1. Install the airflow measuring stations in strict compliance with the manufacturer's recommendation for upstream and downstream straight duct clearances and devices.

I. Check and verify location of thermostats and exposed control sensors with plans and room details before construction of wall assemblies. Locate between 42 to 48 inches above finished floor. Mount at common elevation within same space. Align with lighting switches . Refer to Section 26 0537.

J. Mount in center of 8x8 inch block face with recessed mounting box and accessory wall adapter plate covering block opening where mounted in concrete masonry units.

K. Mount freeze protection thermostats using flanges and element holders.

L. Use a single sensor for outside air temperature.

M. Mount outdoor thermostats and outdoor sensors indoors, with sensing elements outdoors on north side of building or in shaded location. Mount with sun shield.

N. Mount outdoor thermostats and outdoor sensors away from building discharge openings or doors where conditioned air from building will effect signal. Do not mount on positive pressurized HVAC devices where conditioned air can leak thru opening effecting signal.

O. Provide separable sockets for liquid elements. Mount sockets as specified in Section 23 2113 . Cut element to length for full insertion into well and provide conducting compound.

P. Provide mounting flanges for air bulb elements with extensions as required on insulated ducts to clear insulation.

Q. Install current sensing relays in starter enclosure for equipment served.

R. Provide mixing dampers of opposed blade construction arranged to mix streams.

S. Provide isolation (two position) dampers of parallel blade construction.

T. Install damper operators in accessible locations.

U. Install damper operators on outside of duct in warm areas. Do not install operators in locations at outdoor temperatures.

3.3 SCHEDULES

A. Refer to Sequence of Operation for damper normal positions.

END OF SECTION

SECTION 23 0923 - DIRECT-DIGITAL CONTROL SYSTEM FOR HVAC

PART 1 GENERAL

1.1 SECTION INCLUDES

A. System description.

B. Controllers.

C. Power supplies and line filtering.

D. Controller software.

E. Digital control equipment.

F. Software set-up and application programming.

G. Owner demonstration and training.

H. Commissioning support services.

1.2 RELATED REQUIREMENTS

A. Section 23 0510 -General HVAC Requirements-Demonstration, Training and Instructions.

B. Section 23 0800 - Mechanical Systems Commissioning.

C. Section 23 0913 - INSTRUMENTATION AND CONTROL DEVICES FOR HVAC.

D. Section 23 0994 - HVAC Sequence of Operation.

E. Section 26 0583 – Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 135 - BACnet - A Data Communication Protocol for Building Automation and Control Networks; 2012.

B. MIL-STD-810 - Environmental Engineering Considerations and Laboratory Tests; Revision G, 2014.

C. NFPA 70 - National Electrical Code; 2023 Edition, Including All Applicable Amendments and Supplements.

1.4 SUMMARY

A. The Building Automation System (BAS) shall be comprised of a distributed process network control system complete with all necessary hardware and software including all programming and a complete system of direct digital automatic temperature controls (DDC).

B. The BAS shall be capable of total integration of the facility infrastructure systems with user access to all system data both locally over a secure Intranet within the building and by remote access by a standard Web Browser over the Internet. This shall include HVAC controls, energy management, alarm monitoring, and all trending, reporting maintenance management functions related to building operations as indicated on the drawings or in this specification.

1.5 SYSTEM DESCRIPTION

A. Automatic temperature control field monitoring and control system using field programmable micro-processor based units . All devices down to field level controllers shall communicate using BACnet protocol.

B. Base system on distributed system of fully intelligent, stand-alone controllers, operating in a multi-tasking, multi-user environment on token passing network, with central and remote hardware, software, and interconnecting wire and conduit. Provide Building Controllers (BC), Advanced Application Controllers (AAC), and Application Specific Controllers (ASC) as required to achieve specified sequences and performance. Every device in the system which executes control logic and directly controls HVAC equipment must conform to a standard BACnet Device profile as specified in ANSI/ASHRAE 135, BACnet Annex L.

C. The Contractor shall connect DDC controllers via field bus, to a network controller or I/P router, to communicate the building DDC data to/from the existing User web-servers/workstations in the Physical Plant Office.

D. The BAS shall be a Web based system communicating over the campus Local Area Network (LAN). Contractor shall be responsible for coordination with the College IT department to ensure that the building automation system will perform in the data network environment without disruption to any of other activities taking place on that LAN. TCP/IP connections and addresses will be provided by the College for interface with the network.

E. The BAS shall support standard Web browser access via Intranet/Internet, supporting a minimum of 5 concurrent users.

F. Include computer software and hardware, operator input/output devices, control units, local area networks (LAN), sensors, control devices, actuators.

G. Controls for variable air volume terminals, radiation, reheat coils, unit heaters, fan coils, and the like when directly connected to the control units.

H. Provide control systems consisting of thermostats, control valves, dampers and operators, indicating devices, interface equipment and other apparatus and accessories required to operate mechanical systems, and to perform functions specified.

I. The Contractor shall be responsible for all equipment, cables, installation, and programming to implement the required interface with the campus network.

J. Include installation and calibration, supervision, adjustments, and fine tuning necessary for complete and fully operational system.

1.6 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for each system component and software module.

C. Shop Drawings:

1. Table of Contents listing sheet titles and sheet numbers.

2. Each sheet shall have a title indicating the type of information included and the HVAC system controlled.

3. Provide drawing legend and list of abbreviations.

4. System architecture: Provide a drawing of the proposed system architecture showing configuration and locations for DDC controllers, terminal unit controllers, power and control wiring for each device, and hardware and wiring for connections to networks external to the building.

5. Provide floor plans in electronic and hard copy format locating all control units, workstations, servers, LAN interface devices, gateways, etc. Include all WAN and LAN communication wiring routing, power wiring, power originating sources, and low voltage power wiring. Indicate network number, device ID, address, device instance, MAC address, drawing reference number, and controller type for each control unit. Indicate media, protocol, baud rate, and type of each LAN. All optical isolators, repeaters, end-of-line resistors, junctions, ground locations etc. shall be located on the floor plans. Wiring routing as-built conditions shall be maintained accurately throughout the construction period and the drawing shall be updated to accurately reflect accurate, actual installed conditions coordinated with the work of other trades.

6. DDC system data: Proposed system manufacturer's data sheets on DDC controllers, sensors, meters, relays, actuators, motors, terminal unit controllers, protection devices, and other devices specified herein. Include data on system software packages to be installed and illustrations of proposed graphics displays.

7. Diagrams: Separate field wiring diagrams for each system, motor starting and interlock wiring, ladder diagrams, control wiring, interior electrical circuits of control instruments with terminal and control device designations, actuators and motors, colors of wires, locations of instruments and remote elements, interfaces with communications equipment provided with equipment specified in other Sections, and normal position of relays. Each diagram shall have terminals labeled as they will be marked on the installed equipment. Electrical wiring diagrams shall include diagrams with all wire numbers and terminal block numbers identified. Provide panel termination drawings on separate drawings. Ladder diagrams shall appear on system schematic. Clearly differentiate between portions of wiring, which is existing, factory-installed and portions to be field-installed.

8. The control submittal is to include schematic control drawings showing the configuration of the equipment, the location of all sensors, monitoring inputs, and controlled devices and any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.

9. With each schematic, provide a point summary table listing building number and abbreviation, system type, equipment type, full point name, point description, Ethernet backbone network number, network number, device ID, object ID (object type, instance number). Provide a full points list with the following included for each point:

    a. Controlled system

    b. Point abbreviation/acronym

    c. Point description

    d. Engineering unit to be displayed with the point

    e. Control point or set-point (Yes / No)

    f. Monitoring point (Yes / No)

    g. Intermediate point (Yes / No)

    h. Calculated point (Yes / No)

10. Proposed Graphics: Submittal shall include all proposed displays as required by the project documents and specifications.

11. Sequences of Operation: Complete detailed sequences of operation, including a narrative of the system operation and interactions and interlocks with other systems; notations indicating whether interlock or interaction is accomplished through software or hard-wired connections; detailed delineation of control between packaged controls and the DDC system; and sequences of operation for packaged controlled equipment that interfaces with the DDC system describing what points the DDC system monitors only and what points are control points and are adjustable. Sequence shall include:

    a. Equipment start-up sequences.

    b. Warm-up mode sequences.

    c. Normal operating mode sequences.

    d. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, capacity control, staging, optimization, etc.

    e. Temperature and pressure control: setbacks, setups, resets, etc.

    f. Shutdown sequences.

g. Unoccupied mode sequences.

h. Sequences for all alarms and emergency shut downs.

i. Effects of power or equipment failure with all standby component functions.

j. Seasonal operational differences and recommendations.

k. Initial and recommended values for all adjustable settings, set-points and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.

l. Schedules, if known.

m. All sequences shall be written in small statements, each with a number for reference. For a given system, numbers will not repeat for different sequence sections, unless the sections are numbered

12. BACnet Systems:

a. BACnet object description, object ID, and device ID, for each I/O point.

b. Documentation for any non-standard BACnet objects, properties, or enumerations used detailing their structure, data types, and any associated lists of enumerated values.

c. Submit PICS indicating the BACnet functionality and configuration of each controller.

13. Electronic Submittals: While all requirements for hard copy submittal apply, control submittals and O&M information shall also be provided in electronic format as follows.

a. Drawings and Diagrams: Schematic flow diagrams and system architecture diagrams shall be provided on electronic media as AutoCAD 2005 or later version drawing files. Other drawings and diagrams may be provided as either AutoCAD files or PDF files, as most appropriate.

b. Other Submittals: All other submittals shall be provided in Adobe Portable Document Format.

D. Manufacturer's Instructions: Indicate manufacturer's installation instructions for all manufactured components.

E. Project Record Documents: Record actual locations of control components, including control units, thermostats, and sensors.

F. Operation and Maintenance Data:

1. Include interconnection wiring diagrams complete field installed systems with identified and numbered, system components and devices.

2. Include keyboard illustrations and step-by-step procedures indexed for each operator function.

3. Include inspection period, cleaning methods, cleaning materials recommended, and calibration tolerances.

4. Provide maintenance instructions and spare parts lists for each type of control device, control unit, and accessory.

5. Provide BAS User's Guides (Operating Manuals) for each controller type and for all workstation hardware and software and workstation peripherals.

6. Provide BAS advanced Programming Manuals for each controller type and for all workstation software.

7. Include all submittals (product data, shop drawings, control logic documentation, hardware manuals, software manuals, installation guides or manuals, maintenance instructions and spare parts lists) in maintenance manual; in accordance with requirements of Divisions 1 and 23.

8. Provide as-built network architecture drawings showing all BACnet nodes including a description field with specific controller identification, description and location information.

9. Record copies shall include individual floor plans with controller locations with all interconnecting wiring routing including space sensors, LAN wiring, power wiring, low voltage power wiring. Indicate device instance, MAC address and drawing reference number.

10. Provide record system architecture riser diagram showing the location of all controllers.

11. Complete original issue diskettes for all software provided, including operating systems, programming language, backup copy of programming code for the controllers in the project, operator workstation software and graphics software.

12. Licenses, guarantees, and warranty documents for all equipment and systems.

13. Maintain project record documents throughout the construction period and submit final documents at Material Completion.

G. Observation by Architect: Provide an affidavit to Architect stating the Controls Systems are performing in accordance with the contract documents prior to Request for Substantial Completion.

H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in the Owner s name and registered with manufacturer.

I. Certificate: Provide Manufacturer's Certificate complying with the requirements of the General Conditions.

1.7 QUALITY ASSURANCE

A. Perform work in accordance with NFPA 70.

B. Personnel: Mechanics and electricians performing this work shall be regularly engaged in the installation of automatic temperature controls and be in the direct employ of the installing company and shall have a copy of the approved submittal data in immediate possession when performing work.

C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.8 WARRANTY

A. See Section 01 7800 - Closeout Submittals for additional warranty requirements.

B. All components, system software, and parts furnished and installed by the BAS contractor shall be guaranteed against defects in materials and workmanship for one year from date of Material Completion. Project-specific software, database software, and firmware updates which resolve known software deficiencies as identified by the BAS Contractor shall be provided to the Owner at no charge during the warranty period. All corrective software modifications made during warranty period shall be updated on all user documentation and on user and manufacturer archived software disks.

C. At Material Completion, the BAS contractor shall upgrade all control software and firmware packages to the latest release available from the vendor.

D. Provide five year manufacturer's warranty for field programmable micro-processor based units.

1.9 PROTECTION OF SOFTWARE RIGHTS

A. The owner shall sign a copy of the manufacturer's standard software and firmware licensing agreement as a condition of this contract. Such license shall grant use of all programs and application software to owner as defined by the manufacturer's license agreement, but shall protect manufacturer's rights to disclosure of trade secrets contained within such software. All project developed software and documentation shall become the property of the owner. These include, but are not limited to:

1. Project graphic images

2. Record drawings

3. Project network database

4. Project-specific application programming code

5. All documentation.

B. The Contractor shall provide additional software licensing as follows:

1. Provide or upgrade all licensing for all software packages at all required workstations. Building automation system licensing shall allow unlimited simultaneous users for access to all aspects of the system including system access, workstations, points, programming, database management, graphics etc. No restrictions shall be placed on the licensing. All operator interfaces, programming environment, networking, database management and any other software used by the Contractor to install the system or needed to operate the system to its full capabilities shall be licensed and provided to the Owner.

2. All software should be available on all Operator Workstations or servers provided, and on all Portable Operator Terminals. Hardware and software keys to provide all rights shall be installed on all workstations. At least 2 sets of CDs shall be provided with backup software for all software provided, so that the Owner may reinstall any software as necessary. Include all licensing for workstation operating systems, and all required third-party software licenses.

3. Provide licensing and original software copies for each Operator Workstation or server.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Siemens AG, Building Technologies Division; Apogee: www.siemens.com/#sle.

2.2 BACnet COMMUNICATION

A. Control products, communication media, connectors, repeaters, hubs, and routers shall comprise a BACnet internetwork. Controller and operator interface communication shall conform to the latest edition of ANSI/ASHRAE Standard 135, BACnet.

B. Each controller shall have a communication port for temporary connection to a laptop computer or other operator interface. Connection shall support memory downloads and other commissioning and troubleshooting operations.

C. Controllers with real-time clocks shall use the BACnet Time Synchronization service. The system shall automatically synchronize system clocks daily from an operator-designated controller via the internetwork. If applicable, system shall automatically adjust for daylight saving and standard time.

D. Web server or workstation and controllers shall communicate using BACnet protocol. Web server or workstation and control network backbone shall communicate using ISO 8802-3 (Ethernet) Data Link/Physical layer protocol and BACnet/IP addressing as specified in ANSI/ASHRAE 135, BACnet Annex J.

E. The system shall use BACnet as the native communication protocol between distributed controllers communicating on the controller network (i.e., Field Bus) and must, as a minimum, support the following Objects and Application Services (Conformance Class 3):

1. Objects > Binary Input Services > Readproperty
2. Binary Output Writeproperty
3. Binary Value
4. Analog Input
5. Analog Output ReadMutipleProperty
6. Analog Value WriteMultipleProperty
7. Calendar
8. Schedules

2.3 BUILDING CONTROL UNITS

A. Modular in design and consisting of processor board with programmable RAM memory, local operator access and display panel, and integral interface equipment. The BC(s) shall provide fully distributed control independent of the operational status of operator work stations or web-servers. All necessary calculations required to achieve control shall be executed within the BC independent of any other device. All control strategies performed by the BC(s) shall be both operator definable and modifiable through the Operator Interfaces. Each BC shall provide intelligent, standalone control of HVAC functions. Each BC may be capable of standalone direct digital operation utilizing its own processor, non-volatile memory, input/output, wiring terminal strips, A/D converters, real-time clock/calendar and voltage transient and lightning protection devices.

B. All controllers other than those used for terminal equipment shall be defined as a BC unit.

C. Battery Backup: For minimum of 48 hours for complete system including RAM without interruption, with automatic battery charger.

D. All local controller operating parameters, setpoints, and schedules shall be stored in non-volatile EEPROM memory.

E. Arrange Unit and Unit I/O so that control unit functions continue if communications over network are lost.

F. Control Units Functions:

1. Monitor or control each input/output point.

2. Completely independent with hardware clock/calendar and software to maintain control independently.

3. Acquire, process, and transfer information to operator station or other control units on network.

4. Accept, process, and execute commands from other control unit's or devices or operator stations.

5. Access both data base and control functions simultaneously.

6. Record, evaluate, and report changes of state or value that occur among associated points. Continue to perform associated control functions regardless of status of network.

7. Perform in stand-alone mode:

   a. Start/stop.

   b. Automatic Temperature Control.

   c. Event initiated control.

   d. Calculated point.

   e. Scanning and alarm processing.

   f. Full direct digital control.

   g. Trend logging.

   h. Global communications.

G. Global Communications:

1. Broadcast point data onto network, making that information available to all other system control units.

2. Transmit any or all input/output points onto network for use by other control units and utilize data from other control units.

H. Input/Output Capability:

1. Discrete/digital input (contact status) isolated, either N.O. or N.C. as specified.

2. Discrete/digital output: Isolated relay contacts with built-in HOA switch rated for 1 amp at 24 VAC, minimum.

3. Analog input: Compatible with sensors specified in Instruments and Control Elements.

4. Analog Output: Supervised Analog output compatible with operator (0-10VDC, 4-20mA) with built-in HOA and manual positioner, 8 bit minimum.

5. Pulse input (5 pulses/second).

6. Pulse output (0-655 seconds in duration with 0.01 second resolution).

I. Provide transient protection on all I/O signals where cable or device is external to building.

J. Monitor, control, or address data points. Mix shall include analog inputs, analog outputs, pulse inputs, pulse outputs and discrete inputs/outputs, as required. Each building controller shall be provided with a minimum of one spare digital and analog output points, and two universal input points.

K. Point Scanning: Set scan or execution speed of each point to operator selected time from 1 to 250 seconds.

L. Upload/Download Capability: Download from or upload to operator station. Upload/Download time for entire control unit database maximum 10 seconds on hard wired LAN, or 60 seconds over voice grade phone lines.

M. Test Mode Operation: Place input/output points in test mode to allow testing and developing of control algorithms on line without disrupting field hardware and controlled environment. In test mode:

1. Inhibit scanning and calculation of input points. Issue manual control to input points (set analog or digital input point to operator determined test value) from work station.

2. Control output points but change only data base state or value; leave external field hardware unchanged.

3. Enable control actions on output points but change only data base state or value.

2.4 TERMINAL UNIT CONTROLLERS

A. Control of terminal units is to be accomplished by microprocessor-based stand-alone terminal unit controllers utilizing direct digital control. An individual terminal unit controller shall be provided for each terminal unit and shall interface to the DDC system. Each terminal unit controller shall contain resident programming which is field-selectable for the specific application. Each terminal unit controller is to be accessible from the central or local operator station and remote operator's terminals for purposes of control parameter and setpoint adjustment and monitoring. An operator's terminal connected to any DDC controller on the network shall have access to the terminal unit controllers. Terminal unit controllers shall also be accessible through a communications port at the space sensor.

B. All local controller operating parameters, setpoints, and schedules shall be stored in non-volatile EEPROM memory.

C. DDC terminal unit actuators are to be provide complete modulating control for the full range of damper movement. Actuators shall be de-energized when the damper has reached the operator

or system determined position. Actuators shall be removable for servicing without removing the terminal unit. Actuators shall be nonstall spring return type.

D. Terminal air unit controllers controlling damper positions to maintain a quantity of supply or exhaust air serving a space shall have an automatically initiated function that resets the volume regulator damper to the fully closed position on a scheduled basis. The controllers shall initially be set up to perform this function once every 24 hours. The purpose of this required function is to reset and synchronize the actual damper position with the calculated damper position and to assure the damper will completely close when commanded. The software shall select scheduled boxes randomly and shall not allow more than 5% of the total quantity of controllers in a building to perform this function at the same time. When possible the controllers shall perform this function when the supply or exhaust air system is not operating or is unoccupied.

2.5 POWER SUPPLIES AND LINE FILTERING

A. Power Supplies:

1. Provide UL listed control transformers with Class 2 current limiting type or over-current protection in both primary and secondary circuits for Class 2 service as required by the NEC.

2. Limit connected loads to 80 percent of rated capacity.

3. Match DC power supply to current output and voltage requirements.

4. Unit to be full wave rectifier type with output ripple of 5.0 mV maximum peak to peak.

5. Regulation to be 1 percent combined line and load with 100 microsecond response time for 50 percent load changes.

6. Provide over-voltage and over-current protection to withstand a 150 percent current overload for 3 seconds minimum without trip-out or failure.

7. Operational Ambient Conditions: 32 to 120 degrees F.

8. EM/RF meets FCC Class B and VDE 0871 for Class B and MIL-STD 810 for shock and vibration.

9. Line voltage units UL recognized and CSA approved.

B. Power Line Filtering:

1. Provide external or internal transient voltage and surge suppression component for all workstations and controllers.

2.6 LOCAL AREA NETWORK (LAN)

A. Provide communication between control units and operator station(s) over local area network (LAN).

B. LAN Capacity: Not less than 60 stations or nodes.

C. Break in Communication Path: Alarm and automatically initiate LAN reconfiguration.

D. LAN Data Speed: Minimum 10 Mbps.

E. Transmission Median: Fiber optic or single pair of solid 24 gauge twisted, shielded copper cable.

F. Network Support: Time for global point to be received by any station, shall be less than 3 seconds. Provide automatic reconfiguration if any station is added or lost. If transmission cable is cut, reconfigure two sections with no disruption to system's operation, without operator intervention.

2.7 OPERATING SYSTEM SOFTWARE

A. Input/Output Capability From Operator Station:

1. Request display of current values or status in tabular or graphic format.

2. Command selected equipment to specified state.

3. Initiate logs and reports.

4. Change analog limits.

5. Add, delete, or change points within each control unit or application routine.

6. Change point input/output descriptors, status, alarm descriptors, and engineering unit descriptors.

7. Add new control units to system.

8. Modify and set up maintenance scheduling parameters.

9. Develop, modify, delete or display full range of color graphic displays.

10. Automatically archive select data even when running third party software.

11. Provide capability to sort and extract data from archived files and to generate custom reports.

12. Support two printer operations.

a. Alarm printer: Print alarms, operator acknowledgments, action messages, system alarms, operator sign-on and sign-off.

b. Data printer: Print reports, page prints, and data base prints.

B. Operator System Access: Via software password with minimum 30 access levels at work station and minimum 3 access levels at each control unit.

C. Data Base Creation and Support: Changes shall utilize standard procedures. Control unit shall automatically check work station data base files upon connection and verify data base match. Minimum capability shall include:

1. Add and delete points.
2. Modify any point parameter.
3. Change, add, or delete English language descriptors.
4. Add, modify, or delete alarm limits.
5. Add, modify, or delete points in start/stop programs, trend logs, etc.
6. Create custom relationship between points.
7. Create or modify DDC loops and parameters.
8. Create or modify override parameters.
9. Add, modify, and delete any applications program.
10. Add, delete, develop, or modify dynamic color graphic displays.

D. Dynamic Color Graphic Displays:

1. Utilizes custom symbols or system supported library of symbols.
2. Sixteen (16) colors, minimum.
3. Sixty (60) outputs of real time, live dynamic data per graphic.
4. Dynamic graphic data.
5. 1,000 separate graphic pages, minimum.
6. Modify graphic screen refresh rate between 1 and 60 seconds.

E. Existing Operator Station:

1. Accept data from LAN as needed without scanning entire network for updated point data.
2. Interrogate LAN for updated point data when requested.
3. Allow operator command of devices.
4. Allow operator to place specific control units in or out of service.
5. Allow parameter editing of control units.
6. Store duplicate data base for every control unit and allow down loading while system is on line.

7. Control or modify specific programs.

8. Develop, store and modify dynamic color graphics.

9. Provide data archiving of assigned points and support overlay graphing of this data utilizing up to four (4) variables.

F. Alarm Processing:

1. System input and status objects shall be configurable to alarm on departing from and on returning to normal state. Operator shall be able to enable or disable each alarm and to configure alarm limits, alarm limit differentials, alarm states, and alarm reactions for each system object. Configure and enable alarm points as specified in Sequences of Operation and as designated by the User. Additional alarms can be added to all system points in the future without additional software, hardware or wiring, Alarms shall be BACnet alarm objects and shall use BACnet alarm services.

2. Alarm Messages

   a. Alarm messages shall use an English language descriptor without acronyms or mnemonics to describe alarm source, location, and nature.

3. Alarm Reactions

   a. Operator shall be able to configure (by object) the actions that workstation or web server shall initiate on receipt of each alarm. As a minimum, workstation or web server shall be able to log, print, start programs, display messages, send e-mail and page notification, and audibly annunciate. The send e-mail alarm action should be able to run a report and attach it to the e-mail. The e-mail shall use SSL to secure the communications between the system server and the mail server.

   b. Operator shall also be able to set the following conditions for an alarm action:

      1) Run the alarm action only when the alarm source generates an alarm or when it returns to normal.

      2) Wait a specified amount of time, then run the alarm action if the alarm has not been acknowledged or has not returned to normal.

      3) Run if the alarm occurs during the occupied hours defined for a schedule group, or run if the alarm occurs during the group's unoccupied hours.

4. Alarm Maintenance

   a. Operators shall be able to view system alarms and changes of state chronologically, to acknowledge and delete alarms, and to archive closed alarms to the workstation or web server hard disk from each workstation or web browser interface.

G. Event Processing: Automatically initiate commands, user defined messages, take specific control actions or change control strategy and application programs resulting from event condition. Event condition may be value crossing operator defined limit, change-of-state, specified state, or alarm occurrence or return to normal.

H. Automatic Restart: Automatically restart field equipment on restoration of power. Provide time delay between individual equipment restart and time of day start/stop.

I. Messages:

1. Automatically display or print user-defined message subsequent to occurrence of selected events.

2. Compose, change, or delete any message.

3. Display or log any message at any time.

4. Assign any message to any event.

J. Reports:

1. Manually requested with time and date.

2. Long term data archiving to hard disk.

3. Automatic directives to download to transportable media such as floppy diskettes for storage.

4. Data selection methods to include data base search and manipulation.

5. Data extraction with mathematical manipulation.

6. Data reports shall allow development of XY curve plotting, tabular reports (both statistical and summary), and multi-point timed based plots with not less than four (4) variables displayed.

7. Generating reports either normally at operator direction, or automatically under work station direction.

8. Reports may either manually displayed or printed, or may be printed automatically on daily, weekly, monthly, yearly or scheduled basis.

9. Include capability for statistical data manipulation and extraction.

10. Provide capability to generate four types of reports: Statistical detail reports, summary reports, trend graphic plots, x-y graphic plots.

K. Parameter Save/Restore: Store most current operating system, parameter changes, and modifications on disk or diskette.

L. Data Collection:

1. The supplied system must incorporate the ability to access all data using browsers without requiring proprietary operator interface and configuration programs. An Open DataBase Connectivity (ODBC) compliant web-server database is required for all system database parameter storage to allow all historical data to be easily imported into any ODBC compliant software (i.e. Microsoft ACCESS, EXCEL, etc.) This data shall reside on a supplier-installed server for all database access. Systems requiring proprietary database and user interface programs shall not be acceptable.

2. Automatically collect and store in disk files.

3. Provide archiving of stored data for use with system supplied custom reports.

M. Trends:

1. The contractor shall build graphic trends for the following for each HVAC system, with multiple trend points:

   a. Analog outputs trend with output value, control input variable, setpoint value, reset value, modes, one trend per control loop.

   b. Analog input trend with all input variables for a system.

   c. Digital input/output trend with all digital variables for a system.

2. Operator shall be able to configure trend sample or change of value (COV) interval, start time, and stop time for each system date object. Controller shall sample and store trend data and shall be able to archive data to the existing web-server. Owner shall be able to add additional trend points, intranet and internet viewable, and build trend graphs to display without additional hardware or software. Authorized operators shall have the capability of viewing trends from any workstation that is connected to the web.

N. Graphic Display: Support graphic development on work station with software features:

1. Page linking.

2. Generate, store, and retrieve library symbols.

3. Single or double height characters.

4. Sixty (60) dynamic points of data per graphic page.

5. Pixel level resolution.

6. Animated graphics for discrete points.

7. Analog bar graphs.

8. Display real time value of each input or output line diagram fashion.

O. Maintenance Management:

1. Run time monitoring, per point.

2. Maintenance scheduling targets with automatic annunciation, scheduling and shutdown.

3. Equipment safety targets.

4. Target point reset, per point.

P. Advisories:

1. Summary which contains status of points in locked out condition.

2. Continuous operational or not operational report of interrogation of system hardware and programmable control units for failure.

3. Report of power failure detection, time and date.

4. Report of communication failure with operator device, field interface unit, point, programmable control unit.

2.8 LOAD CONTROL PROGRAMS

A. General: Support inch-pounds and SI (metric) units of measurement.

B. Automatic Time Scheduling:

1. Self-contained programs for automatic start/stop/scheduling of building loads.

2. Support up to seven (7) normal day schedules, seven (7) "special day" schedules and two (2) temporary day schedules.

3. Special days schedule shall support up to 30 unique date/duration combinations.

4. Any number of loads assigned to any time program; each load can have individual time program.

5. Each load assigned at least 16 control actions per day with 1 minute resolution.

6. Sequence starting of equipment with motors 3 KW or larger with adjustable time delay.

7. Minimum of 30 holiday periods up to 100 days in length may be specified for the year.

8. Create temporary schedules.

9. Broadcast temporary "special day" date and duration.

C. Start/Stop Time Optimization:

1. Perform optimized start/stop as function of outside conditions, inside conditions, or both.

2. Adaptive and self-tuning, adjusting to changing conditions unattended.

3. For each point under control, establish occupancy period, desired temperature at beginning and end of occupancy period and modify start/stop times, operation of ventilation dampers & toilet exhaust fans.

D. Night Setback/Setup Program: Reduce heating space temperature setpoint or raise cooling space temperature setpoint during unoccupied hours; in conjunction with scheduled start/stop and optimum start/stop programs.

E. Calculated Points: Define calculations and totalization computed from monitored points (analog/digital points), constants, or other calculated points.

1. Employ arithmetic, algebraic, Boolean, and special function operations.

2. Treat calculated values like any other analog value, use for any function that a "hard wired point" might be used.

F. Event Initiated Programming: Event may be initiated by any data point, causing series of controls in a sequence.

1. Define time interval between each control action between 0 to 3600 seconds.

2. Output may be analog value.

3. Provide for "skip" logic.

4. Verify completion of one action before proceeding to next. If not verified, program shall be able to skip to next action.

G. Direct Digital Control: Each control unit shall provide Direct Digital Control software so that the operator may customize control strategies and sequences of operation by defining the appropriate control loop algorithms and choosing the optimum loop parameters.

1. Control loops: Defined using "modules" that are analogous to standard control devices.

2. Output: Paired or individual digital outputs for pulse-width modulation, and analog outputs, as required.

3. Firmware:

a. PID with analog or pulse-width modulation output.

b. Floating control with pulse-width modulated outputs.

c. Two-position control.

d. Primary and secondary reset schedule selector.

e. Hi/Lo signal selector.

f. Single pole double throw relay.

g. Single pole double throw time delay relay with delay before break, delay before make and interval time capabilities.

4. Direct Digital Control loops: Downloaded upon creation or on operator request. On sensor failure, program shall execute user defined failsafe output.

5. Display: Value or state of each of the lines which interconnect DDC modules.

H. Fine Tuning Direct Digital Control PID or floating loops:

1. Display information:

a. Control loop being tuned

b. Input (process) variable

c. Output (control) variable

d. Setpoint of loop

e. Proportional band

f. Integral (reset) Interval

g. Derivative (rate) Interval

2. Except from a start-up, maximum allowable variance from setpoint during functional testing for controlled variables shall be as follows:

a. Air temperature ± 1°F

b. Air humidity ± 5% RH

c. Space temperature ± 0.5°F

d. Chilled water temperature ± 0.5°F

e. Heating water temperature ± 0.5°F

f. Duct pressure ± 0.2 inches w.g.

g. Water pressure ± 2 psid

3. Display format: Graphic, with automatic scaling; with input and output variable superimposed on graph of "time" vs "variable".

I. Trend logging:

1. Each control unit will store samples of control unit's data points.

2. Update file continuously at discretely assignable intervals.

3. Automatically initiate upload request and then store data on hard disk.

4. Time synchronize sampling at operator specified times and intervals with sample resolution of one minute.

5. Co-ordinate sampling with on/off state of specified point.

6. Display trend samples on work station in graphic format. Automatically scale trend graph with minimum 60 samples of data in plot of time vs data.

7. The contractor shall assist the Owner in setting up the HVAC system trending functions during training. The specifications for the trends shall be defined by the Owner for identification by name, and recall by that name.

2.9 PROGRAMMING APPLICATION FEATURES

A. Trend Point:

1. Sample up to 6 points, real or computed, with each point capable of collecting samples at intervals specified in minutes, hours, days, or month.

2. Output trend logs as line graphs or bar graphs. Output graphic on terminal, with each point for line and bar graphs designated with a unique pattern, vertical scale either actual values or percent of range, and horizontal scale time base. Print trend logs up to 12 columns of one point/column.

B. Alarm Messages:

1. Allow definition of minimum of 50 messages, each having minimum length of 180 characters for each individual message.

2. Assign alarm messages to system messages including point's alarm condition, point's off-normal condition, totalized point's warning limit, hardware elements advisories.

3. Output assigned alarm with "message requiring acknowledgments".

4. Operator commands include define, modify, or delete; output summary listing current alarms and assignments; output summary defining assigned points.

C. Weekly Scheduling:

1. Automatically initiate equipment or system commands, based on preselected time schedule for points specified.

2. Provide program times for each day of week, per point, with one minute resolution.

3. Automatically generate alarm output for points not responding to command.

4. Provide for holidays, minimum of 100 consecutive holidays.

5. Output summary: Listing of programmed function points, associated program times, and respective day of week programmed points by software groups or time of day.

D. Interlocking:

1. Permit events to occur, based on changing condition of one or more associated master points.

2. Binary contact, high/low limit of analog point or computed point shall be capable of being utilized as master. Same master may monitor or command multiple slaves.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify existing conditions before starting work.

B. Verify that conditioned power supply is available to the control units and to the operator work station.

C. Verify that field end devices, wiring, and pneumatic tubing is installed prior to installation proceeding.

3.2 PROGRAMING

A. Include operating system programming of software capability specified to provide:

1. Set-up of system I/O capability, operator access as defined by the User, database creation and support.

2. Graphic Display-Levels: Provide graphic display leveling scheme for building site, floor plans, and system diagrams as follows:

a. Level 1: Identify location of building on the site.

b. Level 2: Show each floor plan of the building.

c. Level 3: Show each mechanical room and equipment layout.

d. Level 4: Show each individual system such as chilled water loop, heating water loop, air handling units, exhaust systems, terminal units, etc.

3. Graphic Display-Systems:

a. Provide and generate dynamic color graphics providing menu-generated flow charting of each building process using background graphics, standard and user defined symbols and dynamic variables.

b. Provide flow charting for each system indicating all available points.

c. Indicate setpoint condition status by changing color, flashing. Provide flow charting for each system indicating all available points.

d. Dynamic updates: All graphic I/O object values shall update with change of value, or by operator selected discrete intervals.

4. Graphic Displays- Floor Plans:

a. Provide building floor plan graphics with thermographics or temperature readouts and a change in color during alarms.

b. Show actual locations of equipment, and thermostats on the graphics.

5. Graphic Trends: - Each HVAC System:

a. Analog outputs trend with output value, control input variable, setpoint value, reset value, modes, one trend per control loop.

b. Analog input trend with all input variables for a system.

c. Digital input/output trend will all digital variables for a system.

6. Sequences of Operation:

a. Provide a graphic screen displaying the written out full sequence of operation for each piece of HVAC equipment.

b. Provide a link to the sequence of operation displays on their respective equipment graphics.

7. Equipment Runtime monitoring.

B. Include Load Control and HVAC programming of software to provide:

1. System and equipment operating to specified Sequence of Operation:

2. Start-stop Optimization.

3. Night set-up/set-back of temperature set-points as directed by User.

C. Include Application system programming of software capability specified to provide:

1. Trend logging:

a. Logging, reporting and graphing of user defined system trends on disk file and printer as directed by user.

b. Organize data in each trend logs to facilitate documenting system operation in compliance with Sequence of Operation.

2. Alarms: Logging, reporting and printing of user defined system alarms on disk file and printer as directed by user.

3. Scheduling:

    a. Program user defined system scheduling of HVAC systems as directed by user.

3.3 INSTALLATION

A. Install control units and other hardware in position on permanent walls where accessible for inspection, maintenance and repair and not subject to excessive vibration.

B. Install software in control units and in operator work station. Implement all features of programs to specified requirements and appropriate to sequence of operation. Refer to Section 23 0993.

C. Identification:

1. Nameplates: Identify all sensors mounted in mechanical rooms using device ID and number from control drawings with permanent label mounted adjacent to device. Nameplates shall be engraved plastic laminate with uppercase black letters on a white field, 1/4 inch minimum height.

    a. Mounting: Attach nameplates with epoxy cement or non-ferrous screws after final painting.

2. Conduit/Cable Markers:

    a. Color coded, sunlight resistant cable ties.

    b. Location: Install on all conduit and raceways exposed or above ceilings in a visible location at:

        1) Connections to junction, pull boxes, or manholes. Label box cover with nominal system voltage, circuit number and panel identification legibly written with permanent marker.

        2) Connections to equipment.

        3) Each side of a wall, roof or floor penetration.

        4) Along straight runs at 50 feet intervals.

        5) At changes of direction.

        6) Parallel Conduits: Group markers on each conduit in-line with the adjacent marker.

    c. Color: Baby Blue.

3. Color code cable with both ends identified with manufactured alpha-numeric self-adhesive vinyl tags, 3 mils thick, minimum, keyed to termination points.

D. Communication Wiring:

1. All wiring shall be in accordance with National Electrical Codes and Division 26 of this specification. Communication wiring shall be provided in a customized color jacketing material. Material color shall be as submitted and approved. In addition all wiring jackets shall be labeled “BAS” in 3 foot or fewer intervals along the length of the jacket material.

2. Contractor shall supply all communication wiring between Controllers, Routers, and other devices.

3. Control LAN For any portions of this network required under this section of the specification, contractor shall use Category 5 or better cable as specified in TIA-568B. Media shall be Class 2 plenum rated and installed in accordance with manufacturer's recommendations. Network shall be run with no splices and separate from any wiring over thirty (30) volts.

E. Signal Wiring:

1. Contractor shall run all signal wiring in accordance with National Electric Codes and Division 26 of this Specification.

2. Signal wiring to all field devices, including, but not limited to, all sensors, transducers, transmitters, switches, etc. shall be twisted, 100% shielded pair, minimum 18-gauge wire with PVC cover, Class 2 plenum rated. Signal wiring shall be run with no splices and separate from any wiring above thirty (30) volts.

3. Signal wiring shield shall be grounded at controller end only unless otherwise recommended by the controller manufacturer.

F. Low Voltage Analog Output Wiring:

1. Contractor shall run all low voltage control wiring in accordance with National Electric Codes and Division 26 of this Specification.

2. Low voltage control wiring shall be minimum 18-gauge, twisted pair, 100% shielded, with PVC cover, Class 2 plenum-rated. Low voltage control wiring shall be run with no splices separate from any wiring above thirty (30) volts.

G. Electrical wiring:

1. All terminations of field wiring shall be to terminal strips.

2. Power wiring to control units shown on drawings is provided under Division 26. Provide conduit and conductors and power supplies and transformers to extend power to all supplemental control units.

3. Wiring System: Install complete wiring system for electric control systems. Conceal wiring except in mechanical rooms and areas where other conduit and piping are exposed. Installation of wiring shall generally follow building lines. Install in accordance with National Electrical Code and Division 26 of this Specification. Fasten flexible conductors bridging cabinets and doors, neatly along hinge side, and protect against abrasion. Tie and support conductors neatly.

4. Control Wiring Conductors: Install control wiring conductors, without splices between terminal points, color-coded. Install in neat workmanlike manner, securely fastened. Install in accordance with National Electrical Code and Division 26 of this Specification.

5. Communication wiring, signal wiring and low voltage control wiring shall be installed separate from any wiring over thirty (30) volts. Signal wiring shield shall be grounded at controller end only, unless otherwise recommended by the controller manufacturer.

6. All control network wiring shield shall be terminated as recommended by controller manufacturer. All control network wiring shall be labeled with a network number, NodeID at each termination and shall correspond with the network architecture and floor plan submittals.

7. Install all control wiring external to panels in electric metallic tubing or raceway. Installation of wiring shall generally follow building lines. Provide compression type connectors. Provide rigid conduit at all exterior locations and where subjected to moisture. All conduits penetrating partitions, walls or floors shall be sealed with an approved material to prevent migration of air through the conduit system and maintain the required firestopping performance. Communication wiring, signal wiring and low voltage control wiring may be run without conduit in concealed, accessible locations if noise immunity is ensured. Contractor will be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance. Accessible locations are defined as areas inside mechanical equipment enclosures, such as heating and cooling units, instrument panels etc.; in accessible pipe chases with easy access, or suspended ceilings with easy access. Installation of wiring shall generally follow building lines. Run in a neat and orderly fashion, bundled where applicable, and completely suspended (strapped to rigid elements or routed through wiring rings) away from areas of normal access. Tie and support conductors neatly with suitable nylon ties. Conductors shall not be supported by the ceiling system or ceiling support system. Conductors shall be pulled tight and be installed as high as practically possible in ceiling cavities. Wiring shall not be supported by piping, conduit, the ceiling or ductwork. Conductors shall not be installed between the top cord of a joist or beam and the bottom of roof decking. Contractor shall be fully responsible for noise immunity and rewire in conduit if electrical or RF noise affects performance.

H. Provide conduit and electrical wiring in accordance with Section {\id\#877}. Electrical material and installation shall be in accordance with appropriate requirements of Div 26.

3.4 MANUFACTURER'S FIELD SERVICES

A. Start and commission systems. Allow sufficient time for start-up and commissioning prior to placing control systems in permanent operation.

B. Provide start-up certificate in the format prescribed by the General Conditions.

3.5 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Provide services of control contractor's qualified technical personnel to instruct the Using Agency Facilities personnel in operation and maintenance of the control system. Instruction shall be in classroom setting at the project site.

B. Refer to Section 23 0510- Demonstration, Training and Instructions for additional requirements.

C. All training sessions may be attended by the Commissioning Agent.

D. The standard operating manual for the control system and any special training manuals shall be provided for each trainee. Manuals shall include detailed descriptions of the subject matter for each training session. The manuals shall include system control sequences with a definitions index that fully describes relevant terms used in the manuals and in software displays.

E. The BAS vendor designated training personnel shall meet with the Owner's representative, and the Commissioning Agent for the purpose of discussing and fine-tuning the training agenda prior to the first training session. The training plan shall be submitted 30 days prior to the scheduled training sessions.

F. Training shall occur after the functional testing for the systems has been completed.

G. Training shall be provided for up to 5 individuals.

H. The Training Agenda shall include the following:

1. Session 1:

a. Brief walk-through of building, including identification of all controlled equipment and condensed demonstration of portable and built-in operator interface devices and display capabilities.

b. Brief overview of the various parts of the O&M manual, including hardware and software programming and operating publications, catalog data, controls installation drawings, and DDC programming documentation.

c. Demonstration of workstation login/logout procedures, password setup, and exception reporting.

d. Demonstration of workstation menu penetration and broad overview of the various workstation features.

2. Session 2:

    a. General Review of sequence of operation, control unit programming, standalone modes, fail modes and graphic workstation screen for each HVAC subsystem.

    b. Demonstration and set-up of alarm feature.

    c. Demonstration and set-up of diagnostics features.

    d. Demonstration of workstation graphic screens and functions.

    e. Demonstration and set-up of trend feature.

    f. Demonstration and set-up of workstation reports

    g. Fail modes and procedures to take in the event of and following a power outage.

    h. Standalone modes and procedures to take in the event of and following various communication failures.

    i. Question and answer period.

3. Session 3:

    a. Review of previous sessions.

    b. Introduction to programming (utilize typical site specific programs) for all control unit types.

    c. Demonstration of Control Unit features, diagnostics, program upload/download.

    d. Demonstration of I/O hardware testing, calibration, and replacement.

    e. Review of sequence of operation, control unit programming, standalone modes, fail modes and graphic workstation screen for each HVAC subsystem.

    f. Demonstration of workstation diagnostics features, program upload/download capabilities and software backup concepts.

    g. Question and answer period.

4. Session 4:

    a. Review of previous sessions.

    b. Review of alarm, diagnostics, trends, graphics, and report features.

    c. Review of fail modes and standalone modes and corresponding procedures to follow.

    d. Review of I/O hardware testing, calibration, and replacement.

e. Start-up, Setpoint Adjustment, Scheduling and Shutdown Procedures for each system.

f. Demonstration of setpoint optimization and fine-tuning concepts.

g. Demonstration of control unit features, diagnostics, program upload /download.

h. Question and answer period.

5. Session 5:

a. Review of previous sessions.

b. Review of all remaining miscellaneous workstation features.

c. Review of setpoint optimization and fine-tuning concepts.

d. Programming examples (utilize typical site specific programs) for all control unit types.

e. Demonstration of workstation diagnostics features, program upload/download capabilities and software backup concepts.

f. Question and answer period.

I. Deferred Training, Testing, and Programming:

1. This session shall be conducted on-site approximately six months after occupancy for a minimum of 4 hours. Follow-up training shall be scheduled and structured to address specific topics and review questions concerning operation of the building automation system.

2. Contractor shall provide 8 hours of control technician on-site support to verify programming and control loop tuning during off-season testing.

3. Contractor shall provide 8 hours of control technician on-site support for reprogramming as directed by the Owner.

END OF SECTION

SECTION 23 0994 - HVAC SEQUENCE OF OPERATION

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Listing of required monitor points.

B. Sequence of operation for:

1. Fan Sequences and Interlocks.

2. Air Terminal units.

3. Packaged VAV Air Conditioning Units.

1.2 RELATED SECTIONS

A. Section 23 0923 - Digital Control Equipment.

B. Section 23 0913 - Instruments and Control Elements.

C. Section 26 2717 - Equipment Wiring: Electrical characteristics and wiring connections.

1.3 SYSTEM DESCRIPTION

A. This Section defines the manner and method by which controls function. Requirements for each type of control system operation are specified. Equipment, devices, and system components required for control systems are specified in other Sections.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Shop Drawings: Indicate mechanical system controlled and control system components.

1. Label with settings, adjustable range of control and limits.

2. Include written description of control sequence.

3. Include flow diagrams for each control system, graphically depicting control logic.

C. Project Record Documents: Record actual locations of components and setpoints of controls, including changes to sequences made after submission of shop drawings.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.1 GENERAL

A. All operators shall be in NORMAL position when each system is OFF.

B. Provide smoke detector in supply air stream on all air systems over 2000 CFM.

C. Provide smoke detector in return air stream on all air systems over 15,000 CFM.

D. Provide control power circuits to operate damper actuators in ductwork and dampers serving air handling systems.

E. All temperatures are Fahrenheit.

F. Sequences specified herein indicate the functional intent of the systems operation and may not fully detail every aspect of the programming that may be required to obtain the indicated operation. Contractor shall provide all programming necessary to obtain the sequences/system operation indicated.

G. When an air handling unit is not in operation, control devices shall remain in their "off" positions. "Off" positions may differ from the "normal" (meaning failed) position. Except as specified otherwise, "off" and "normal" positions of control devices shall be as follows:

1. Outside Air Damper:

    a. "Off" Position: Closed.

    b. "Normal" Position: Closed.

2. Exhaust/Relief Air Damper:

    a. "Off" Position: Closed.

    b. "Normal" Position: Closed.

3. Variable Frequency Drive:

    a. "Off" Position: Off.

    b. "Normal" Position: Off.

4. Return Air Damper:

    a. "Off" Position: Open.

    b. "Normal" Position: Open.

H. Except as specified otherwise, throttling ranges, proportional bands, and cycle differentials shall be centered on the associated setpoint. All modulating feedback control loops shall include the capability of having proportional, integral, and derivative action. Unless the loop is specified "proportional only" or "P+I", Contractor shall apply appropriate elements of integral and derivative gain to each control loop which shall result in stable operation, minimum settling time, and shall maintain the primary variable within the specified maximum allowable variance.

I. Where any sequence or occupancy schedule calls for more than one motorized unit to start simultaneously, the DDC System start commands shall be staggered by 5 second (adj.) intervals to minimize inrush current.

J. Alarm messages specified throughout the sequences shall be assigned to discrete priority levels. Priority levels dictate the handling and destination of alarm reports.

K. Wherever a value is indicated as adjustable (adj.), it shall be modifiable, with the proper password level, from the operator interface or via a function block menu. For these points, it is unacceptable to have to modify programming statements to change the setpoint.

L. When a power failure is detected in any phase, the DDC System start commands shall be retracted immediately from all electrically powered units served by the failed power source. If the associated primary control panel (ACP) is powered by normal or emergency power, it may monitor its own power source as an indication of power status. If the ACP is powered by uninterruptable power supply (UPS), or if ACP is not capable of monitoring its own power for use in sequences, Contractor shall provide at least one voltage monitor (three phase when applicable). When the DDC System detects that power has been restored, all equipment for which the DDC System start command had been retracted shall be automatically restarted on staggered 5 second intervals to minimize inrush current. When loss of equipment status coincides with a power failure, system shall not alarm individual equipment failures. Instead, only a single alarm shall be enunciated as follows:

1. BUILDING POWER FAILURE: Acknowledge alarm when power is restored.

M. Where reset action is specified in a sequence of operation, but a reset schedule is not indicated on the drawings, the contractor shall determine a fixed reset schedule that shall result in stable operation and shall maintain the primary variable within the specified maximum allowable variance one of the following methods shall be employed. Obtain approval of reset schedule from Engineer. All parameters of reset schedule shall be adjustable without programming statement modifications.

N. The DDC System shall provide for adjustable maximum rates of change for increasing and decreasing output from the following analog output points:

1. Speed control of variable speed drives.

O. Wherever a value is indicated to be dependent on another value (i.e.: setpoint plus 5°F) the DDC System shall use that equation to determine the value. Simply providing a virtual point that the operator must set is unacceptable. In this case three virtual points shall be provided. One to store the parameter (5°F), one to store the setpoint, and one to store the value which is the result of the equation.

3.2 MONITOR POINTS

A. Arrangement: Locate all control points for a system within one DDC panel within the mechanical equipment room containing the majority of the equipment for that system.

B. Each DDC controller including associated input/output modules, shall be provided with a minimum of three spare input and output points of each type installed.

C. Monitoring: In addition to the temperature, pressure, digital or flow sensor points required to implement the sequence of operation, refer to the HVAC system flow diagrams and Input/Output point Schedules shown on the drawings.

3.3 PACKAGED VAV AIR CONDITIONERS

A. Supply Fan Start-Stop:

1. A normally open digital output relay on time of day programming commands the variable frequency speed controller.

2. The minimum OA damper is opened at the occupied time.

3. The digital output relay stops the fan.

4. Digital thermostat un-occupied high and low limits shall start unit fan when any space temperature exceeds 85 degrees or is 60 degrees or lower during un-occupied times.

B. Safety Controls to Stop Supply Fan:

1. Firestat in R.A. duct.

2. Normally closed fire alarm output relay (hardwire).

C. Supply Fan Capacity Control:

1. Fan speed shall be modulated through variable speed drive to maintain most open VAV unit on system to be no more than 95% of wide open position. Provide static pressure sensor in supply duct where indicated on Drawings or, if not shown, locate at 2/3 of the way down supply duct. Show static pressure on graphics display for each air handler. Graphics shall display zone currently setting static pressure.

2. Provide interface to variable speed drive to monitor amperage, drive output frequency, ON-OFF status, drive alarm status. Display these on air handler graphics screen.

D. Minimum OA Dampers:

1. The normally closed minimum OA damper shall open when air unit SA fan is on and the time of day indicates the building is occupied.

2. OA damper shall modulate between minimum and maximum position proportionally with SA fan. Set maximum and minimum damper positions at Test and Balance.

E. Economizer: Factory provided controller shall open OA dampers to provide 100% outside air when ODT temperature is 55 degrees.

F. Building Pressurization: The system Power Exhaust Fan shall operate during economizer sequence and modulate through the building static pressure sensor to maintain 0.03"-0.05" W.G. max. positive building pressurization control. Provide a building pressure sensor for each RTU.

3.4 AIR TERMINAL UNITS

A. Terminal Units:

1. DDC space thermostat thru terminal unit controller modulates variable volume dampers from maximum to minimum position to maintain set point temperature.

2. During unoccupied period, the terminal unit is controlled using the unoccupied setpoint limits. The controller may reset to the occupied mode for a predetermined interval upon signal from the BAS.

B. Terminal Units with Heating Coil (Cooling Min/Max - Heating Min/Max):

1. Cooling: DDC space thermostat thru terminal unit controller modulates the variable air volume damper from maximum to the cooling minimum CFM setpoint to maintain the cooling setpoint. At cooling minimum CFM, stage electric heating coil from SCR controller to maintain set point temperature.

2. Heating: DDC space thermostat thru terminal unit controller modulates the variable air volume damper from the heating minimum to the heating maximum CFM setpoints and stages electric heating coil from SCR controller to maintain heating set point temperature. The discharge air temperature shall not exceed 20° F above the space temperature setpoint.

3. During unoccupied period, the terminal unit is controlled using the unoccupied setpoint limits. The controller may reset to the occupied mode for a predetermined interval upon signal from the BAS.

4. Cooling-Heating change-over: Use the room temperature and the demand for heating or cooling to switch unit control from cooling to heating mode and back thru the BAS.

C. Fan Powered Series Induction Boxes:

1. Unit fans run when respective unit supply fan is ON or by unoccupied low or high limit. Provide fan start sequence so that box fans on series boxes are operating before system supply fan starts.

2. Cooling/Heating: DDC space thermostat thru terminal unit controller modulates variable volume air dampers from maximum to minimum position to maintain set point temperature. On call for heating, the DDC space thermostat shall stage electric heating coil from SCR controller to maintain setpoint temperature. The discharge air temperature shall not exceed 20° F above the space temperature setpoint.

3. During unoccupied period, the unit is controlled using the unoccupied setpoint limits. The controller may reset to the occupied mode for a predetermined interval upon signal from the BAS.

3.5 MISCELLANEOUS FAN SEQUENCES

A. General: Where exhaust fans are indicated to be interlocked with air handling equipment, fans shall be interlocked with minimum outside air dampers for indicated equipment, unless otherwise noted.

B. Exhaust Fans: EF-1 and EF-4

1. ON when RTU-3A OA damper is open.

C. Exhaust Fans: EF-5,EF-6, EF-9, EF-10 and EF-11

1. ON when RTU-3B OA damper is open.

D. Toilet Exhaust Fans: EF-2, EF-3, EF-7 and EF-8

1. Interlock with toilet room lights.

END OF SECTION

SECTION 23 3100 - HVAC DUCTS AND CASINGS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Metal ductwork.

B. Flexible Ducts.

C. Ductwork Fabrication.

D. Pressure testing.

1.2 RELATED REQUIREMENTS

A. Section 09 9123 - Interior Painting: Weld priming, paint or coating.

B. Section 23 0593 - Testing, Adjusting and Balancing for HVAC.

C. Section 23 0713 - Duct Insulation: External insulation and duct liner.

D. Section 23 3300 - Air Duct Accessories.

E. Section 23 3600 - Air Terminal Units.

1.3 REFERENCE STANDARDS

A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.

B. ASTM A240/A240M - Standard Specification for Chromium and Chromium-Nickel Stainless Steel Plate, Sheet, and Strip for Pressure Vessels and for General Applications; 2015b.

C. ASTM A480/A480M - Standard Specification for General Requirements for Flat-Rolled Stainless and Heat-Resisting Steel Plate, Sheet, and Strip; 2015.

D. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2015.

E. ASTM A1008/A1008M - 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; 2015.

F. ASTM B209M - Standard Specification for Aluminum and Aluminum-Alloy Sheet and Plate [Metric]; 2014.

G. ASTM C443M - Standard Specification for Joints for Concrete Pipe and Manholes, Using Rubber Gaskets (Metric); 2011.

H. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2015a.

I. SMACNA (LEAK) - HVAC Air Duct Leakage Test Manual; Sheet Metal and Air Conditioning Contractors' National Association; 1985, First Edition.

J. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

K. SMACNA Round Industrial Duct Construction Standards; 1999, 2nd Edition.

L. SMACNA - Duct Cleanliness for New Construction Guidelines., 2000.

M. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4 DEFINITIONS

A. Low Pressure Duct: Duct having Pressure Class of 2-inches or less.

B. Medium or High pressure Duct: Duct having Pressure Class over 2-inches.

1.5 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for :

1. Duct take-off fittings.

2. Manufactured metal ductwork and fittings.

3. Flexible ducts.

4. Transverse Duct Connection System.

C. Shop Drawings: Refer to Section 23 0510 for duct shop drawing requirements.

D. Test Reports: Indicate pressure tests performed. Include date, section tested, test pressure, and leakage rate, following SMACNA (LEAK).

E. Manufacturer's Installation Instructions: Indicate special procedures for glass fiber ducts.

F. Project Record Documents: Record actual locations of ducts and duct fittings. Record changes in fitting location and type. Show additional fittings used.

1.6 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience, and approved by manufacturer.

B. Installer Qualifications: Company specializing in performing the type of work specified in this section, with minimum five years of documented experience.

1.7 FIELD CONDITIONS

A. Do not install duct sealants when temperatures are less than those recommended by sealant manufacturers.

B. Maintain temperatures within acceptable range during and after installation of duct sealants.

1.8 DELIVERY, STORAGE, AND PROTECTION(REFER TO DUCT CLEANLINESS LEVEL SPECIFIED IN INSTALLATION)

A. Store in clean dry place and protect from weather and construction traffic.

B. Exercise care during construction to prevent the accumulation of dust, dirt, and refuse in the supply and return ductwork.

C. All openings shall be tightly closed with 8-mil polyethylene when work creating dust and debris is in progress.

PART 2 PRODUCTS

2.1 MATERIALS

A. Galvanized Steel for Ducts: Hot-dipped galvanized steel sheet, ASTM A653/A653M FS Type B, with G90/Z275 coating.

B. Joint Sealers and Sealants: Non-hardening, water resistant, mildew and mold resistant.

1. Type: Heavy mastic or liquid used alone or with tape, suitable for joint configuration and compatible with substrates, and recommended by manufacturer for pressure class of ducts.

2. VOC Content: Not more than 250 g/L, excluding water.

3. Surface Burning Characteristics: Flame spread index of zero and smoke developed index of zero, when tested in accordance with ASTM E84.

4. Manufacturers:

a. Manufacturers (water based): Ductmate Proseal, Hardcast IronGrip 601, Marathon 460, Foster 32-19; Childers CP-146, DuroDyne SAS.

C. Hanger Rod: ASTM A36/A36M; steel, galvanized; threaded both ends, threaded one end, or continuously threaded.

2.2 DUCTWORK FABRICATION

A. General:

1. Fabricate and support in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

C. Construct T's, bends, and elbows with radius of not less than 1-1/2 times width of duct on centerline. Where not possible and where rectangular elbows must be used, provide air foil turning vanes of perforated metal with glass fiber insulation.

D. Provide turning vanes of perforated metal with glass fiber insulation when acoustical lining is indicated.

E. All dimensions are net inside metal measurements in inches unless otherwise shown.

F. Duct sizes shown include allowance for liner thickness unless otherwise noted, except sizes shown for lined round spiral and flat oval duct are sizes of perforated inner liner

G. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips.

H. Low Pressure Duct- Supply, Return, and Exhaust (2" Class or less):

1. Longitudinal Seams:

a. Corner Seams: Fig. 2-2, Type L1 (Pittsburgh Lock).

1) Corner seams for ducts less than 18 inch, L-2 (Button Punch Snap Lock) is acceptable.

b. Fig. 2-2, Type L-3 for seams other than corner.

2. Transitions:

a. Changes in duct sizes shall be made by transitions.

b. Refer to Fig. 4-7, CONCENTRIC TRANSITION, unless otherwise noted.

c. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

d. Transitions shall be provided between equipment and duct where sizes are not the same.

3. Rectangular Duct:

a. Elbows:

1) Mitered with turning vanes. Type RE 2, Figure 4-2, unless otherwise noted.

b. Turning Vanes:

1) Turning vanes shall be in accordance with Figs 4-3 and 4-4, unless otherwise noted.

2) Provide single wall vanes for ducts 18" width or less.

3) Provide double wall vanes for ducts over 18" width.

c. Splits and Tees:

1) Fig. 4-5, Type 1, Type 2 (with stationary splitter), 4A, or 4B only.

2) Use of Square Throat Elbow with Turning Vanes is acceptable, unless otherwise noted.

(a) Provide volume control damper in each branch.

3) Omit volume control damper in Return and Exhaust duct unless otherwise noted.

d. Where acoustical lining is indicated, provide acoustical turning vanes of perforated metal with glass fiber insulation.

4. Round Duct - Manufactured Spiral Duct:

a. Elbows: Radius elbow with radius not less than 1-1/2 times width of duct on centerline.

5. Branch and Runout Connections:

a. Entry fittings for Return and Exhaust: Construct for a 45 degree entry angle to ease the turbulence created by converging airstreams. Increase the minimum length shown in Fig. 4-6, 45 DEGREE ENTRY, from 4 inch to 6 inch.

b. Rectangular Branch or Runout from Rectangular Duct:

1) Fig. 4-6, 45 DEGREE ENTRY, with flange and gasket for connection to trunk with a minimum of six screws.

c. Round Branch or Runout from Rectangular Duct:

1) Fig. 4-6, 45 DEGREE LEAD IN, with flange and gasket for connection to trunk with a minimum of six screws.

2) Provide volume control damper with locking quadrant at branch or runout connection.

d. Round Branch or Runout from Round Duct:

1) Fig. 3-5, 90 DEGREE tee fitting with 45 DEGREE oval to round tap, unless otherwise noted.

2) Fig. 3-6, CONICAL TEE fitting.

e. Rectangular Runout to Sidewall Grille/Register:

1) Fig. 4-6, 45 DEGREE ENTRY, with flange and gasket for connection to trunk with a minimum of six screws.

6. Offsets: Fig. 4-7, Type 1 and Type 3 only, unless otherwise indicated.

7. Dampers: Fig. 7-4, SINGLE BLADE TYPE, or 7-5, MULTIBLADE TYPE.

8. Reinforcement:

a. Fabricate ducts in clearance critical areas such as chases and above ceilings to unreinforced standards, Fig. 2-8.

1) Tie Rod Reinforcement is acceptable in Supply, Return, and Exhaust duct only.

2) No screw or rivets are allowed to penetrate ducts.

I. Medium Pressure Rectangular and Round Duct- Supply (Higher Than 2" Pressure Class):

1. Provide Shop Fabricated Ductwork.

2. Transitions:

a. Changes in duct sizes shall be made by transition fittings.

b. Refer to Fig. 4-7, CONCENTRIC TRANSITION, unless otherwise noted.

c. Increase duct sizes gradually, not exceeding 15 degrees divergence wherever possible; maximum 30 degrees divergence upstream of equipment and 45 degrees convergence downstream.

d. Transitions shall be provided between equipment and duct where sizes are not the same.

3. Rectangular Duct:

a. Longitudinal Seams:

1) Corner Seams: Fig. 2-2, Type L1 (Pittsburgh Lock).

(a) Corner seams for ducts less than 18 inch, L-2 (Button Punch Snap Lock) is acceptable.

2) Fig. 2-2, Type L-3 for seams other than corner.

b. Elbows:

1) Radius Type RE 1, Figure 4-2 with radius not less than 1-1/2 times width of duct on centerline.

2) Where rectangular elbows are indicated on the drawings, construct in accordance with Figure 4-2, Type RE 2 (mitered w/vanes).

c. Turning Vanes:

1) Turning vanes shall be in accordance with Figs 4-3 and 4-4, unless otherwise noted.

2) Provide single wall vanes for ducts 18" width or less.

3) Provide double wall vanes for ducts over 18" width.

d. Tees and Splits:

1) Fig. 4-5, Type 1, 4A, or 4B only. Radius elbows only, unless otherwise noted.

e. Where acoustical lining is indicated, provide acoustical turning vanes of perforated metal with glass fiber insulation.

4. Round Duct - Manufactured Spiral Duct

a. Elbows: Radius with radius not less than 1-1/2 times width of duct on centerline, unless otherwise noted.

5. Branch and Runout Connections:

a. Entry fittings for Return and Exhaust: Construct for a 45 degree entry angle to ease the turbulence created by converging airstreams. Increase the minimum length shown in Fig. 4-6, 45 DEGREE ENTRY, from 4 inch to 6 inch.

b. Rectangular Branch or Runout from Rectangular Duct:

1) Fig. 4-6, 45 DEGREE ENTRY, with flange and gasket for connection to trunk with a minimum of six screws.

c. Round Branch or Runout from Rectangular Duct:

1) Fig. 4-6, 45 DEGREE LEAD IN, with flange and gasket for connection to trunk with a minimum of six screws.

d. Round or Flat Oval Branch or Runout from Round or Flat Oval Duct:

1) Fig. 3-6, CONICAL FITTING, unless otherwise noted.

2) Fig. 3-6, CONICAL TAP is acceptable only where noted on drawings.

3) Fig. 3-6, CONICAL TEE AND REDUCER FITTING.

4) Fig. 3-5, 45 DEGREE LATERAL FITTING.

5) Refer to drawings for indication of whether the fitting is lateral or 90 degree angle.

e. Rectangular Branch or Runout from Round Duct:

1) Fig. 4-6, 45 DEGREE ENTRY, with flange and gasket for connection to trunk with a minimum of six screws.

6. Offsets: Fig. 4-7.

7. Bellmouths: Fig. 4-7.

8. Pressure Relief/Access Door:

a. Fig. 7-3, COMBINATION ACCESS AND PRESSURE RELIEF.

b. Provide downstream of all fire dampers and where indicated on drawings.

9. Reinforcement:

a. Fabricate ducts in clearance critical areas such as chases and above ceilings to unreinforced standards, Fig. 2-8.

b. Tie Rod Reinforcement is acceptable in Rectangular Supply duct only.

c. No screw or rivets are allowed to penetrate ducts.

J. Fabricate continuously welded round and oval duct fittings in accordance with SMACNA (DCS).

K. Ducts Connecting to Wall Louvers:

1. Provide sheet metal plenum sealing louver area and connecting duct.

2. Fabricate in accordance with Fig. 6-1.

3. Fabricate plenum using same material and pressure class as connecting duct.

4. Paint exterior side of plenum flat black.

2.3 MANUFACTURED DUCTWORK AND FITTINGS

A. Manufacture in accordance with SMACNA HVAC Duct Construction Standards - Metal and Flexible, and as indicated. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

B. Round Ducts: Machine made from round spiral lockseam duct.

1. Manufacture in accordance with SMACNA (DCS).

2. Machine made from round spiral lockseam duct with light reinforcing corrugations; fittings manufactured of at least two gages heavier metal than duct.

3. Fittings: Seams shall be fully welded. Tack welding and sealing is not acceptable.

4. Take-offs: Take-offs to terminal units, etc. shall be tee fittings, except;

   a. where saddletaps are indicated on Drawings or,

   b. duct manufactured by McKenney's, Inc. may be saddle-tap connections, installed by cutting hole and field welded tap to straight section of duct and sealed.

5. Transformations: Transformations shall comply with lengths indicated in United Metal (McGill Airflow catalogs (maximum of 24" long)

6. Provide relief type access panels (RAP) downstream of all fire dampers and where indicated on drawings

7. Fittings: Manufacture at least two gages heavier metal than duct.

8. Provide duct material, gages, reinforcing, and sealing for operating pressures indicated.

9. Manufacturer-Layout Basis: United McGill Corporation.

   a. Other Acceptable manufacturers:

      1) BH&W Sheetmetal (Atlanta)

      2) Dixie Sheet Metal Products.

      3) Don Park, Inc.

      4) Eastern Sheet Metal.

      5) Hamlin Sheet Metal Company.

      6) Lindab, Inc.

      7) McKenney's, Inc. (Atlanta)

      8) Monroe Metals.

      9) Semco.

      10) South Spiral Pipe, Inc.

C. Flexible Ducts: UL 181, Class 1, aluminum laminate and polyester film with latex adhesive supported by helically wound spring steel wire.

   1. Insulation: Fiberglass insulation with polyethylene vapor barrier film.

2. Insulation thickness shall be 1 inch thick, minimum; 3/4 lbs./cu ft, minimum.

3. Pressure Rating: 10 inches WG positive and 1.0 inches WG negative.

4. Maximum Velocity: 4000 fpm.

5. Temperature Range: Minus 20 degrees F to 210 degrees F.

6. Manufacturers:

a. Atco Rubber Products, Inc; Model UPC-037: www.atcoflex.com.

b. Flexible Technologies Group-Thermaflex, Inc; Model M-KE: www.thermaflex.net

c. Flexmaster USA; Model Type 3M: www.flexmasterusa.com.

d. Wiremold, Inc; Model WK: www.wiremold.com.

D. Transverse Duct Connection System: SMACNA "E" rated rigidly class connection, interlocking angle and duct edge connection system with sealant, gasket, cleats, and corner clips in accordance with SMACNA (DCS).

PART 3 EXECUTION

3.1 INSTALLATION

A. Install, support, and seal ducts in accordance with SMACNA (DCS).

B. Install in accordance with manufacturer's instructions.

C. During construction provide temporary closures of metal or taped polyethylene on open ductwork to prevent construction dust from entering ductwork system.

D. Duct sizes for lined duct are net metal and include allowance for liner. For unlined duct, sizes are inside clear dimensions.

E. Duct sizes for runouts to Air Terminals shall match the size of the device unless otherwise noted.

F. Duct Cleanliness level: Advanced Level in accordance with SMACNA Duct Cleanliness for New Construction Guidelines.

G. Provide openings in ductwork where required to accommodate thermometers and controllers. Provide pilot tube openings where required for testing of systems, complete with metal can with spring device or screw to ensure against air leakage. Where openings are provided in insulated ductwork, install insulation material inside a metal ring.

H. Locate ducts with sufficient space around equipment to allow normal operating and maintenance activities.

I. Use double nuts and lock washers on threaded rod supports.

J. Seal all transverse and longitudinal joints in all metal supply, exhaust and return ducts.

1. Class A seal for pressure class 4 in. wg and higher.

2. Class B seal for pressure class less than 4 in. wg.

K. Supply duct run-out to inlet of terminal unit shall be the same size as the terminal unit connection unless indicated otherwise on the Drawings.

L. Connect terminal units to supply ducts directly or with one foot maximum length of flexible duct. Do not use flexible duct to change direction.

M. Connect diffusers to concealed low pressure ducts directly or with 5 feet maximum length of flexible duct held in place with metal strap or clamp.

N. Secure flexible ducts to metal ducts with draw bands and metal strap or clamp.

O. Patch Plates/ Duct Cap: Provide where openings in existing ducts are closed. Plate shall be same material as duct being patched and one gauge heavier than scheduled for the duct size and pressure class at the patched location. Secure with sheet metal screws 6 inches maximum on center with a minimum of two screws for each side.

3.2 PRESSURE TESTING

A. Pressure test new ductwork in accordance with SMACNA HVAC Air Duct Leakage Test Manual.

1. 4 inch WG or higher: Class 6 for rectangular ducts and Class 3 for round and oval ducts.

B. Leakage testing shall be performed for the horizontal ductwork installation in the pressure classification specified. Each section shall include at minimum - 5 transverse joints, typical seams, one elbow, one access door, and 2 typical branch duct connections. Include at least two fire dampers in the total scope of testing.

C. All vertical ductwork located within riser shafts shall be pressure tested. The tests shall include each branch connection tap extending to a point just beyond the shaft wall.

D. Ductwork which fails the leakage testing shall be reconstructed and retested until acceptable, before additional ductwork is installed and before ductwork is concealed.

E. Follow-up testing of each pressure classification will be required, at the Owner's discretion, if subsequent duct installation becomes suspect and does not appear to maintain the same level of quality as the sections tested.

F. The Construction Manager shall coordinate the schedule for duct testing with the project Test and Balance contractor.

G. Five days before each test, the sheet metal contractor shall submit marked shop drawings of the duct section(s) to be tested, and the allowable leakage calculations required by the SMACNA test procedure standard.

H. The Construction Manager shall coordinate with the CxA for scheduling and witnessing of the duct leakage testing.

I. Duct Leakage Test Reporting:

1. Description of ductwork under test
2. Duct design operating pressure
3. Duct design test static pressure
4. Duct capacity, air flow
5. Maximum allowable leakage duct capacity times leak factor
6. Test apparatus
    a. Blower
    b. Orifice, tube size
    c. Orifice size
    d. Calibrated
7. Test static pressure
8. Test orifice differential pressure
9. Leakage rate

3.3 SCHEDULES

A. Ductwork Material:

1. Low Pressure Supply: Galvanized Steel.
2. Medium and High Pressure Supply: Galvanized Steel.
3. Return and Relief: Galvanized Steel.
4. General Exhaust: Galvanized Steel.
5. Outside Air Intake: Galvanized Steel.
6. Louver Plenums: Galvanized Steel.

B. Ductwork Pressure Class:

1. Supply System downstream of Air Terminal Units: 2 inch.
2. Supply System upstream of Air Terminal Units: 6 inch (medium pressure).
3. Return and Relief: 2 inch.
4. General Exhaust: 2 inch negative.
5. Outside Air Intake: 2 inch negative.

END OF SECTION

SECTION 23 3300 - AIR DUCT ACCESSORIES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Duct access doors.

B. Fire dampers.

C. Flexible duct connections.

D. Volume control dampers.

1.2 RELATED REQUIREMENTS

A. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

B. Section 23 3100 - HVAC Ducts and Casings.

1.3 REFERENCE STANDARDS

A. SMACNA (DCS) - HVAC Duct Construction Standards Metal and Flexible; 2005.

B. UL 33 - Safety Heat Responsive Links for Fire-Protection Service; Current Edition, Including All Revisions.

C. UL 555 - Standard for Fire Dampers; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide for shop fabricated assemblies including volume control dampers. Include electrical characteristics and connection requirements.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

B. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Protect dampers from damage to operating linkages and blades.

PART 2 PRODUCTS

2.1 DUCT ACCESS DOORS(AP)

A. Manufacturer: Cesco Model *AD.

B. Other acceptable manufacturers offering equivalent products: Airstream, Flexmaster Inspector Series, Nailor Industries Model 0800, National Controlled Air ADR, Prefco, Ruskin, Ventlok, Pottorff.

C. Fabrication:

1. Factory fabricated in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, Figures 7-2, 7-3 and as indicated.

2. Rigid and close-fitting of galvanized steel with sealing gaskets and quick fastening locking devices.

3. Install minimum 1 inch thick insulation with sheet metal cover for insulated ducts.

4. Access doors up to 2 inch pressure class:

a. Less Than 12 inches Square: Secure with sash locks.

b. Up to 18 inches Square: Provide two hinges and two sash locks.

c. Up to 24 x 48 inches: Three hinges and two compression latches with outside and inside handles.

d. Larger Sizes: Provide an additional hinge.

5. Fabricate access doors over 2 inch pressure class in accordance with Figure 7-2.

D. Access doors with sheet metal screw fasteners are not acceptable.

2.2 FIRE DAMPERS(FD)

A. Manufacturer: Ruskin.

B. Other acceptable manufacturers offering equivalent products: Advanced Air, Inc., Air Balance, Air Control Products, Airstream, American Warming and Ventilating, Cesco, Greenheck, Louvers and Dampers, Nailor Industries, National Controlled Air, Pacific Air Products, Phillips, Safe-Aire, Shipman, United, Ventco, Pottorff.

C. Fabricate in accordance with NFPA 90A and UL 555 for dynamic systems, and as indicated.

D. Curtain Type Dampers: Galvanized steel with interlocking blades. Provide stainless steel closure springs and latches for horizontal installations.

E. Fusible Links: UL 33, separate at 165 degrees F with adjustable link straps for combination fire/balancing dampers.

F. Dampers shall be Type 'A' with breakaway connections, same size as duct unless otherwise noted. Net damper opening of low resistance type 'B' dampers in retracted position shall not be less than 90% of cross sectional area of attached duct.

G. Dampers in medium pressure ducts shall be Type 'C' with non-breakaway connections and sleeve gauge listed for application .

H. Multiple Fire Damper Assemblies (Vertical Installations; Allowed Only for Sizes Exceeding 48 inches in Length or Width): Fire dampers assembled together to form protection for a single opening shall be provided with steel mullion(s) meeting the requirements of UL 555 Standard for Safety Fire Dampers and Ceiling Dampers.

2.3 FLEXIBLE DUCT CONNECTIONS

A. Fabricate in accordance with SMACNA (DCS) - HVAC Duct Construction Standards - Metal and Flexible, Figures 7-8 and 7-9, and as indicated.

B. Flexible Duct Connections: Fabric crimped into metal edging strip.

C. Fabric: UL listed fire-retardant neoprene coated woven glass fiber fabric to NFPA 90A, minimum density 30 oz per sq yd.

1. Net Fabric Width: Approximately 2 inches wide.

2. Metal: 3 inches wide, 24 gage, 0.0239 inch thick galvanized steel.

2.4 VOLUME CONTROL DAMPERS (MVD).

A. Manufacturer: Ruskin MD35.

B. Other acceptable manufacturers offering equivalent products: Airstream, Arrow, Greenheck, Nailor Industries, National Controlled Air, Prefco, Pottorff.

C. Single Blade Dampers: Figure 7-4. Fabricate for duct sizes up to 6 x 30 inch.

D. Multi-Blade Damper: Figure 7-5. Fabricate of opposed blade pattern with maximum blade sizes 8 x 48 inch long. Assemble center and edge crimped blades in galvanized channel frame with suitable hardware; 16 gauge, minimum, steel channel frame with blade stops top and bottom; 16 gauge steel blades with formed edge groove to have 3/8 inch interlock between adjacent blades, with 1/2 inch diameter cadmium plated shaft extended 6 inches beyond frame and blade linkage.

E. End Bearings: Except in round ducts 12 inches and smaller, provide end bearings. On multiple blade dampers, provide oil-impregnated nylon or sintered bronze bearings.

F. Quadrants:

1. Provide locking, indicating quadrant regulators on single and multi-blade dampers.

2. On insulated ducts mount quadrant regulators on stand-off mounting brackets, bases, or adapters.

3. Where rod lengths exceed 30 inches provide regulator at both ends.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install accessories in accordance with manufacturer's instructions, NFPA 90A, and follow SMACNA (DCS). Refer to Section 23 3100 for duct construction and pressure class.

B. Duct Access Doors:

1. Provide duct access doors for inspection and cleaning before airflow measuring stations, automatic dampers, controls devices, and fire dampers and elsewhere as indicated for service access or cleaning access.

2. Provide minimum 8 x 8 inch size for hand access, 18 x 18 inch size for shoulder access, and as indicated. Provide 4 x 4 inch for balancing dampers only. Review locations prior to fabrication.

C. Label access doors as required by IMC.

D. Provide fire dampers at locations indicated, where ducts and outlets pass through fire rated components. Install with required perimeter mounting angles, sleeves, breakaway duct connections, corrosion resistant springs, bearings, bushings and hinges.

E. Demonstrate re-setting of fire dampers to the Owner's representative.

F. Provide flexible connections immediately adjacent to equipment in ducts associated with fans and motorized equipment, and supported by vibration isolators. Refer to Section 23 0548.

1. Do not install on air handling units with factory flexible connections on fan.

2. Do not install on curb mounted fans or curb mounted range fans.

G. Provide balancing dampers at points on supply, return, and exhaust systems where branches are taken from larger ducts as required for air balancing. Install minimum 2 duct widths from duct take-off.

H. Volume Control Dampers:

1. Install where shown on drawings or required by details.

2. Lock all volume control dampers in the full open position for adjustment by the TAB agency.

END OF SECTION

SECTION 23 3423 - HVAC POWER VENTILATORS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Roof exhausters.

B. Ceiling exhaust fans.

1.2 RELATED REQUIREMENTS

A. Section 23 0513 - Motors for HVAC Equipment.

B. Section 23 0548 - Vibration and Seismic Controls for HVAC Piping and Equipment.

C. Section 23 0583 – Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AMCA 261 - Directory of Products Licensed to Use the AMCA Certified Ratings Seal; Air Movement and Control Association International, Inc.; http://www.amca.org/licenses/search.aspx.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data on fans and accessories including fan curves with specified operating point clearly plotted, power, RPM, sound power levels at rated capacity, and electrical characteristics and connection requirements.

C. Manufacturer's Instructions: Indicate installation instructions.

D. Maintenance Data: Include instructions for lubrication, motor and drive replacement, spare parts list, and wiring diagrams.

E. Maintenance Materials: Furnish the following for the Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Extra Fan Belts: One set for each individual fan.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General HVAC Requirements for delivery, storage and protection requirements.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

1.7 FIELD CONDITIONS

A. Permanent ventilators may be used for ventilation during construction only after ductwork is clean, filters are in place, bearings have been lubricated, and fan has been test run under observation.

1.8 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide a second adjustable sheave for each belt driven fan to place belt at mid-position of sheave at RPM required for final air balance.

PART 2 PRODUCTS

2.1 POWER VENTILATORS - GENERAL

A. Static and Dynamically Balanced: AMCA 204 - Balance Quality and Vibration Levels for Fans.

B. Performance Ratings: Determined in accordance with AMCA 210 and bearing the AMCA Certified Rating Seal.

C. Sound Ratings: AMCA 301, tested to AMCA 300 and bearing AMCA Certified Sound Rating Seal.

D. Fabrication: Conform to AMCA 99.

E. UL Compliance: UL listed and labeled, designed, manufactured, and tested in accordance with UL 705.

F. Electrical Components: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

2.2 ROOF EXHAUSTERS (RF)

A. Manufacturers: Acme PL, Breidert S, Cook HLC, Greenheck LB, PennBarry LC.

B. Fan Unit: V-belt as indicated, with low silhouette ribbed aluminum hood housing hinged for servicing with stainless steel restraining cables; resilient mounted motor; 1/2 inch mesh, 0.62 inch thick aluminum wire birdscreen; square base to suit roof curb with continuous curb gaskets.

C. Roof Curb: Curb height shall provide 8 inch clear above roofing, self-flashing of galvanized steel with continuously welded seams, built-in cant strips, insulation and curb bottom, and factory installed nailer strip.

D. Disconnect Switch: Factory wired, non-fusible, in housing for thermal overload protected motor and wall mounted multiple speed switch. Provide NEMA 1 housing for interior locations and NEMA 3R for exterior locations.

E. Backdraft Damper: Gravity actuated, aluminum multiple blade construction, felt edged with offset hinge pin, nylon bearings, blades linked, and line voltage motor drive, power open, spring return.

F. Drive and Sheaves: Drives rated at 1.5 time motor HP, minimum. Cast iron or steel sheaves, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheave selected so required rpm is obtained with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

2.3 CABINET(CAB) AND CEILING(CLG) EXHAUST FANS

A. Manufacturers: Acme V, Carnes VCDB, Cook Gemini, Greenheck SP, Jenn J, PennBarry Z, Powerline CF, Rupp CF, Twin City TCTB.

B. Motor: Refer to Section 23 0513.

C. Centrifugal Fan Unit: Direct driven unless noted otherwise with galvanized steel housing lined with acoustic insulation, resilient mounted motor, gravity backdraft damper in discharge.

D. Disconnect Switch: Cord and plug-in housing for thermal overload protected motor and wall mounted switch.

E. Capacity Control: Solid State speed controller mounted on/in fan housing.

F. Grille for ceiling mounted fan(s): Molded white plastic.

G. Service Access: Removable grille for ceiling mounted fan(s) or access panel for inline cabinet fan(s).

H. Sheaves: Cast iron or steel, dynamically balanced, bored to fit shafts and keyed; variable and adjustable pitch motor sheaves selected so required rpm is reached with sheaves set at mid-position; fan shaft with self-aligning pre-lubricated ball bearings.

PART 3 EXECUTION

3.1 PREPARATION

A. Seal all duct roof penetrations at roof structure air-tight.

B. Ensure exhaust duct is clean and free of debris.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Provide a second adjustable sheave to place belt at mid-position of sheave at RPM required for final air balance.

C. Install backdraft dampers on inlet to roof and wall exhausters.

D. Provide backdraft dampers on outlet from cabinet and ceiling exhauster fans and as indicated.

3.3 STARTING EQUIPMENT

A. Adjust for proper operation within manufacturer's published tolerances.

B. Demonstrate proper operation of equipment to the Owner 's designated representative.

3.4 SCHEDULES

A. Refer to Schedule on Drawings.

END OF SECTION

SECTION 23 3600 - AIR TERMINAL UNITS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single-duct terminal units.

1. Single-duct, variable-volume units.

B. Fan-powered units.

1.2 RELATED REQUIREMENTS

A. Section 23 0513 - Motors for HVAC Equipment.

B. Section 23 0923 - Direct-Digital Control System for HVAC.

C. Section 23 0994 - HVAC SEQUENCE OF OPERATION.

D. Section 23 3100 - HVAC Ducts and Casings.

E. Section 23 3300 - Air Duct Accessories.

F. Section 26 0583 – Wiring Connections: Electrical characteristics and wiring connections.

1.3 REFERENCE STANDARDS

A. AHRI 880 (I-P) - Performance Rating of Air Terminals; 2011 with Addendum 1.

B. AHRI 885 - Procedure for Estimating Occupied Space Sound Levels in the Application of Air Terminals and Air Outlets; 2008 with Addendum 1.

C. ASHRAE Std 130 - Methods of Testing Air Terminal Units; 2008 (R2014).

D. NFPA 70 - National Electrical Code, 2023 Edition; National Fire Protection Association.

E. UL 181 - Standard for Factory-Made Air Ducts and Air Connectors; current edition, including all revisions.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data indicating configuration, general assembly, and materials used in fabrication. Include catalog performance ratings that indicate air flow, static pressure, and NC designation. Include electrical characteristics and connection requirements.

C. Shop Drawings: Indicate configuration, general assembly, and materials used in fabrication, and electrical characteristics and connection requirements.

D. Include schedules listing discharge and radiated sound power level for each of second through sixth octave bands at inlet static pressures of 1 to 4 inch wg.

E. Manufacturer's Installation Instructions: Indicate support and hanging details, installation instructions, recommendations, and service clearances required.

F. Project Record Documents: Record actual locations of units.

G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, maintenance and repair data, and parts lists. Include directions for resetting constant volume regulators.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Refer to Section 23 0510 - General HVAC Requirements for delivery, storage and protection requirements.

B. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, and fan has been test run under observation.

PART 2 PRODUCTS

2.1 SINGLE-DUCT, VARIABLE-VOLUME UNITS

A. Manufacturers:

1. Titus ESV

2. Other acceptable manufacturers offering equivalent products: Carrier, Envirotec, Johnson Controls, Krueger LMHS, Metal-Aire, Price SDV, Tempmaster, Trane VC, Tuttle&Bailey SDV.

B. General:

1. Factory-assembled, AHRI 880 (I-P) rated and bearing the AHRI seal, air volume control terminal with damper assembly, flow sensor, externally mounted volume controller, duct collars, and all required features.

2. Control box bearing identification, including but not necessarily limited to nominal cfm, maximum and minimum factory-set airflow limits, coil type and coil (right or left hand) connection, where applicable.

C. Unit Casing:

1. Minimum 22 gage, 0.0299 inch galvanized steel.

2. Air Inlet Collar: Provide round, suitable for standard flexible duct sizes.

3. Unit Discharge: Rectangular, with slip-and-drive connections.

4. Acceptable Liners:

   a. Lining: Minimum 3/4 inch thick fiber free elastomeric foamed insulation meeting NFPA 90A requirements and UL 181 erosion requirements. Face lining with mylar film.

5. Access Doors: Sealed, flush type for access to internal components for service and maintenance.

D. Airflow Sensor:

1. Factory furnished and mounted multi-point, flow ring or cross arrangement inlet averaging sensor which will provide a differential pressure signal that represents actual air flow within an accuracy of +5% regardless of inlet configuration.

2. This accuracy shall be maintained when inlet duct varies from straight up to 90 elbow entrance conditions for both flexible and rigid metal duct applications. Straight inlet duct shall not be required for specified accuracy.

E. Damper Assembly:

1. Heavy-gage, galvanized steel or extruded aluminum construction with solid steel, nickel-plated shaft pivoting on HDPE, self-lubricating bearings.

2. Provide integral position indicator or alternative method for indicating damper position over full range of 90 degrees.

3. Incorporate low leak damper blades for tight airflow shutoff.

F. Electric Heating Coil:

1. Listed and provided by the terminal unit manufacturer.

2. Coil Casing: 20 gage, 0.0359 inch galvanized steel.

3. Heating Elements: Nickel chrome, supported by ceramic insulators.

4. Integral Control Panel: NEMA 250, Type 2 enclosure with hinged access door for access to all controls and safety devices.

5. Provide the following additional components, mounted and/or wired within the control enclosure:

   a. Fused or non-fused door interlocking disconnect switch.

   b. Control transformer.

c. Differential pressure airflow switch for proof of airflow.

d. Mercury contactors for the capacity steps scheduled.

e. Fuse block.

6. Proportional SCR Controller:

a. Airflow sensor: Proportional electronic airflow sensor shall be totally independent of the duct static pressure sensors/controls. Controller shall use the sensor to adjust the heater capacity based on the available airflow. The heaters shall deliver up to maximum heating capacity (controlled by input signal from BAS) when air flow is at scheduled maximum. When airflow is below maximum, controller shall reduce capacity (regardless of control signal) in proportion to the airflow reduction and stop heating when there is no airflow.

b. Capacity control: Proportional SCR controller shall modulate the heater output according to the temperature control (BAS) signal. Controller shall be able to utilize at least one of the following control signals as input to modulate heater: Variable 0-10 volts, pulse width modulation or variable 2-20 mA variable current

7. Factory wired, including all limit switches and steps of control as indicated on the equipment schedule, with the SSR (solid-state relay) proportional heat control.

G. Controls:

1. Digital: Factory mount DDC controller and damper actuator supplied by building automation control manufacturer within unit mounted enclosure.

2. Wiring:

a. Factory mount and wire controls. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.

b. Factory mount transformer for control voltage on electric and electronic control units.

c. Wiring Terminations: Wire power and controls to terminal strips. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

3. Control Sequence:

a. Refer to See Section 23 0994.

2.2 FAN-POWERED UNITS

A. Manufacturers

1. Titus TQS. Straight through design.

2. Other acceptable manufacturers offering equivalent products: Buensod CFD, Krueger QFC, Metal-Aire Series 400 FCI, EH Price FPC/FDC, Tuttle&Bailey FPC, Nailor 35P, Trane Model VP.

B. Series Units:

1. General:

a. Factory assembled and wired, AHRI 880 rated, horizontal fan powered terminal unit with blower, blower motor, mixing plenum, and primary air damper contained in a single unit housing.

C. Unit Casing:

1. Minimum 22 gauge, 0.0299 inch galvanized steel.

2. Primary Air Inlet Collar: Suitable for standard flexible duct sizes.

3. Unit Discharge: Rectangular, suitable for flanged duct connection.

4. Plenum Air Inlets: S slip and drive connections for duct attachment.

5. Acceptable Liners:

a. Minimum 3/4 inch thick fiber free elastomeric foamed insulation meeting NFPA 90A requirements and UL 181 erosion requirements.

6. Access Doors: Sealed, flush type for access to internal components for service and maintenance.

D. Airflow Sensor:

1. Factory furnished and mounted multi-point, flow ring or cross arrangement inlet averaging sensor which will provide a differential pressure signal that represents actual air flow within an accuracy of +5% regardless of inlet configuration.

2. This accuracy shall be maintained when inlet duct varies from straight up to 90 elbow entrance conditions for both flexible and rigid metal duct applications. Straight inlet duct shall not be required for specified accuracy.

E. Primary Air Damper Assembly:

1. Heavy-gauge, galvanized steel, or extruded aluminum construction with solid shaft rotating in bearings.

2. Provide indicator on damper shaft or alternative method for indicating damper position over full range of 90 degrees.

3. Incorporate low leak (2 percent) damper blades for tight airflow shutoff.

4. Fan(s): Forward curved, centrifugal type.

5. Fan Motor:

   a. PSC: Thermally protected, single speed, multi-voltage (120, 208/240, 277), 60 cycle, single phase, energy efficient design, permanently lubricated, using permanent split capacitor type for starting and specifically designed for use with a SCR (Silicon Controlled Rectifier) fan speed controller with three speed motors as an acceptable alternative. See Section 22 0513.

   b. Speed Control: Infinitely adjustable with electronic controls.

   c. Fan motor shaft directly connected to fan and isolated from unit casing to prevent transmission of vibration.

6. Isolation: Fan/motor assembly isolated from unit casing on rubber isolators.

F. Electric Heating Coil:

1. Listed and provided by the terminal unit manufacturer.

2. Coil Casing: Minimum 20 gauge, 0.0359 inch galvanized steel.

3. Heating Elements: Open wire, nickel chrome, supported by ceramic insulators.

4. Integral Control Panel: NEMA 250, Type 2 enclosure, with hinged access door for access to all controls and safety devices.

5. Provide the following additional components, mounted and/or wired within the control enclosure:

   a. Fused or non-fused door interlocking disconnect switch.

   b. Auto reset primary and manual reset secondary over-temperature protection cutout.

   c. Differential pressure airflow switch for proof of airflow.

   d. Mercury contactors for the capacity steps scheduled.

   e. Fuse block.

6. Proportional SCR Controller:

   a. Airflow sensor: Proportional electronic airflow sensor shall be totally independent of the duct static pressure sensors/controls. Controller shall use the sensor to adjust the heater capacity based on the available airflow. The heaters shall deliver up to maximum heating capacity (controlled by input signal from BAS) when air flow is at scheduled maximum. When airflow is below maximum, controller shall reduce capacity (regardless of control signal) in proportion to the airflow reduction and stop heating when there is no airflow.

b. Capacity control: Proportional SCR controller shall modulate the heater output according to the temperature control (BAS) signal. Controller shall be able to utilize at least one of the following control signals as input to modulate heater: Variable 0-10 volts, pulse width modulation or variable 2-20 mA variable current

G. Electrical Requirements:

1. Single-point power connection.

2. Equipment wiring to comply with requirements of NFPA 70.

H. Controls:

1. Digital: Factory mount DDC controller and damper actuator supplied by building automation control manufacturer within unit mounted enclosure.

2. Wiring:

a. Factory mount and wire controls. Mount electrical components in control box with removable cover. Incorporate single point electrical connection to power source.

b. Incorporate single point electrical connection to power source.

c. Factory mount transformer for control voltage on electric and electronic control units.

d. Wiring Terminations: Wire power and controls to terminal strips. Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Enclose terminal lugs in terminal box sized to NFPA 70.

e. Disconnect Switch: Factory mount fused disconnect switch in control panel.

3. Control Sequence: See Section 23 0994.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Install the inlets of air terminal units and air flow sensors a minimum of four duct diameters from elbows, transitions, and duct takeoffs.

C. Provide ceiling access doors or locate units above easily removable ceiling components.

D. Support units individually from structure. Do not support from adjacent ductwork.

E. Attach supports to unit without obstructing removable casing panels, control cabinets or other items requiring access for service.

F. Install terminal units in a readily accessible location. Refer to definitions in Section 23 0510.

G. Coordinate with the Contractor so that other trades do not obstruct removable casing panels or other items requiring access for service.

H. Connect to ductwork in accordance with Section 23 3100.

I. Provide minimum of 5 ft of 1 inch thick lined ductwork downstream of units unless indicated otherwise.

3.2 STARTING EQUIPMENT

A. Adjust for proper operation within the manufacturer's published tolerances.

B. Demonstrate proper operation of equipment to the Owner's designated representative.

C. Provide start-up certificate in accordance with the General Conditions.

3.3 SCHEDULES

A. Refer to Schedule on Drawings.

B. Terminal Unit Schedule

1. All CFM values based on 0.50 inches upstream static and 0.375 inches downstream resistance.

2. Maximum inlet velocity 2000 FPM.

3. Max N.C. shall be as scheduled based on certified performance in accordance with AHRI 880-2011.

4. Maximum capacity rating of unit shall be not less than 15% greater than maximum air quantity specified.

END OF SECTION

SECTION 23 3700 - AIR OUTLETS AND INLETS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Diffusers

B. Registers/grilles

C. Security diffusers

1.2 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide data for equipment required for this project. Review outlets and inlets as to size, finish, and type of mounting prior to submission. Submit schedule of outlets and inlets showing type, size, location, application, and noise level.

PART 2 PRODUCTS

2.1 RECTANGULAR LOUVERED FACE (RLF2) CEILING DIFFUSERS

A. Manufacturer: Titus Model TDC.

B. Other acceptable manufacturers offering equivalent products:

1. Nailor Model 6500.

2. Carnes Model SKBA.

3. Price Model SMD.

4. Krueger Model SH.

5. Tuttle & Bailey 'MSR'.

C. Type: Square and rectangular, multi-louvered diffuser with flush face, round neck duct connection and rod mounted air pattern deflectors as required by pattern indicated on floor plans.

D. Frame: Surface Mount, Snap-In, Inverted T-Bar(Lay-in), or Spline type to match ceiling. Refer to schedule on Drawings. A rapid mount plaster sub-frame may be substituted to convert a Lay-in frame for use in a sheetrock or plaster ceiling provided that the diffuser & frame match the face size specified.

E. Fabrication: Diffusers shall be constructed of 24 gauge steel or 0.04 aluminum and shall have a finish as scheduled.

F. Dimensions:

1. The diffuser neck shall have a minimum 1 1/8-inch depth for duct connection.

G. Accessories:

1. Radial opposed blade damper adjustable from diffuser face as scheduled on drawings.

2. Provide 24" x 24" module for ceiling diffusers in a lay-in ceiling.

2.2 CEILING GRID CORE EXHAUST AND RETURN REGISTERS/GRILLES (CGC)

A. Manufacturer: Titus Model 50F

B. Other acceptable manufacturers offering equivalent products:

1. Anemostat GC5

2. Carnes RAPAF

3. Price 80

4. Krueger RA

5. Nailor 51EC.

6. MetalAire CC5

7. Tuttle & Bailey CRE500

C. Type: Fixed grilles of 1/2 x 1/2 x 1/2 inch eggcrate grid core.

D. Fabrication: Aluminum with factory off-white enamel finish.

E. Frame: 1-1/4 inch margin with countersunk screw mounting.

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.3 CEILING SLOT DIFFUSERS(CSD1)

A. Manufacturer: Titus Model ML-*(supply) or MLR-*(return)

B. Other acceptable manufacturers offering equivalent products:

1. Anemostat SLAD

2. Price SDS

3. Krueger 1900-B

4. MetalAire

5. Tuttle & Bailey 6*00F

C. Type: Number and width of slots and length as scheduled and with adjustable vanes for left, right, or vertical discharge .

D. Fabrication: Aluminum extrusions with frame and border type as specified. Provide factory finish of clear lacquer, off-white enamel or baked enamel (color to be selected) as scheduled on drawings. Adjustable vanes shall be finished flat black.

E. Frame for mounting in sheetrock Ceilings 1-1/4 inch margin with concealed mounting and gasket.

F. Plenum: Integral, galvanized steel, insulated. Fabricate to lengths indicated in schedule.

G. Accessories: Provide hanger brackets, spring clips, alignment pins for continuous appearance of multiple sections, end caps and mitered corners to match diffuser type specified and arrangement shown.

2.4 SECURITY DIFFUSER(SG1)

A. Manufacturer: Titus Model SG-TDC

B. Other acceptable manufacturers offering equivalent products:

1. Anemostat SGSDF

2. Krueger Model 1340

3. MetalAire SG-5000.

C. Type: Square and rectangular, multi-louvered diffuser with rectangular neck duct connection and lattice face plate and rod mounted air pattern deflectors as required by pattern indicated on floor plans.

D. Lattice Security face: Face shall be constructed of 12 gauge steel with 13/16" x 13/16" holes on 1" centers.

E. Frame: Surface mount type. In plaster ceilings, provide plaster frame and ceiling frame.

F. Fabrication: Diffusers shall be constructed of 24 gauge steel and shall have a finish as scheduled.

G. Accessories:

1. Radial opposed blade damper adjustable from diffuser face as scheduled on drawings.

2. Security screws to secure lattice face to diffuser.

3. 12 gauge steel sleeve to extend duct connection beyond security barrier.

2.5 WALL SUPPLY REGISTERS/GRILLES-ROUND NOZZLE(WSAR-R):

A. Manufacturer: Air Concepts Model APL-Aluminum Puhkah Louver.

B. Other acceptable manufacturers offering equivalent products:

1. Price .

2. MetalAire.

3. Titus.

C. Type: Concentric ring nozzle elements mounted in a square or rectangular panel frame. Minimum of three rolled deflection rings, adjustable through a plus or minus 30-degree pivot angle and a rotation of 360-degrees.

D. Frame: Heavy gage metal construction with countersunk screw mounting and gasket.

E. Fabrication: Aluminum or steel with 18 gage minimum frames and 20 gage minimum nozzle elements with factory baked enamel finish , color to be selected.

F. Damper: Integral, gang-operated opposed blade type with removable key operator, operable from face.

2.6 WALL EXHAUST AND RETURN REGISTERS/GRILLES (WRAG)

A. Manufacturer: Titus Model 350RL.

B. Other acceptable manufacturers offering equivalent products:

1. Krueger.

2. MetalAire -SRH .

3. Tuttle & Bailey T70D.

C. Type: Streamlined blades, 3/4 inch minimum depth, 3/4 inch maximum spacing, with 35 degree, minimum fixed blade deflection, horizontal face.

D. Frame: 1-1/4 inch margin with countersunk screw mounting.

E. Fabrication: Steel frames and blades, with factory finish .

F. Damper: Integral, gang-operated, opposed blade type with removable key operator, operable from face.

2.7 LOUVERS-ALUMINUM-DRAINABLE BLADE STYLE

A. Manufacturer: Ruskin Model ELF-6375DX.

B. Other acceptable manufacturers offering equivalent products:

1. American Warming & Ventilating LE-33.
2. Air Balance .
3. Arrow EA-615-D.
4. Dowco DW-6.
5. Greenheck ESD-603.
6. Industrial Louvers 653.
7. Louvers & Dampers IEL-6.
8. Shipman LE-33.
9. Tuttle & Bailey DB-645.

C. Type: 6 inch deep with blades on 45 degree slope, drainable blade with gutter, heavy channel frame, 19 gauge birdscreen with 1/2 inch square mesh for exhaust and 3/4 inch for intake.

D. Minimum Free Area: 50%.

E. Fabrication: 12 gage thick extruded aluminum, welded assembly, with factory baked enamel finish color to be selected.

F. Mullions: Provide hidden or exposed mullions to support blades as shown on architectural elevations.

G. Mounting: Furnish with masonry strap anchors for installation.

PART 3 EXECUTION

A. Install in accordance with manufacturer's instructions.

B. Check location of outlets and inlets and make necessary adjustments in position to conform with architectural features, symmetry, and lighting arrangement.

C. Paint ductwork visible behind air outlets and inlets matte black. Refer to Section 09 9123.

3.2 AIR OUTLET AND INLET SCHEDULE

A. Refer to Schedule on Drawings.

END OF SECTION

SECTION 23 4000 - HVAC AIR CLEANING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Disposable, extended area panel filters.

1.2 RELATED SECTIONS

A. Section 23 0510 - General HVAC Requirements - Space Conditioning during construction and building flushout.

B. Section 23 7210: Filters for Filter Sections specified with air handling equipment.

1.3 REFERENCE STANDARDS

A. ASHRAE Std 52.2 - Method of Testing General Ventilation Air-Cleaning Devices for Removal Efficiency by Particle Size; 2012, with 2015 amendments.

B. UL 900 - Standard for Air Filter Units; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General Mechanical Requirements for submittal procedures.

B. Product Data: Provide data on filter media, filter performance data, filter assembly and filter frames, dimensions, motor locations and electrical characteristics and connection requirements.

C. Shop Drawings: Indicate filter assembly and filter frames, dimensions, motor locations, and electrical characteristics and connection requirements.

D. Manufacturer's Installation Instructions: Indicate assembly and change-out procedures.

E. Operation and Maintenance Data: Include instructions for operation, changing, and periodic cleaning.

F. Maintenance Materials: Furnish the following for the Owner's use in maintenance of project.

1. See Section 01 6000 - Product Requirements, for additional provisions.

2. Provide filters whenever any system is operated during construction. Refer to Section 23 0510.

3. For every system requiring fitters;

a. Provide and install one set of new disposable panel filters at Material Completion.

b. Provide one set of spare disposable panel filters at Material Completion.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

PART 2 PRODUCTS

2.1 DISPOSABLE, EXTENDED AREA PANEL FILTERS (EAPF)

A. Manufacturers: American Air Filter Prepleat HC, Air Guard, CamFil-Farr 30/30, Purolator.

B. Media: UL 900 Class 2, pleated, lofted, non-woven, reinforced synthetic media; supported and bonded to welded wire grid by corrugated aluminum separators.

1. Frame: Cardboard.

2. Nominal size: 24 x 24 inches.

3. Nominal thickness: 2 inches.

C. Minimum Efficiency Reporting Value (MERV): 8, when tested in accordance with ASHRAE Std 52.2.

D. Initial resistance at 500 FPM face velocity: 0.20 inch WG.

E. Recommended final resistance: 0.9 inch WG.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install air cleaning devices in accordance with manufacturer's instructions.

B. Prevent passage of unfiltered air around filters with felt, rubber, or neoprene gaskets.

C. Do not operate fan system until filters (temporary or permanent) are in place. Replace temporary filters used during construction and testing, with clean set.

D. Do not install second stage medium or high efficiency filters until project is complete and ready for balancing.

E. Provide 20 gauge sheetmetal safing to prevent bypass airflow around filters.

3.2 SCHEDULES

A. Provide filter media for Packaged VAV Air Conditioners in Section 23 7423.

END OF SECTION

SECTION 23 7423 - PACKAGED ROOF TOP AIR CONDITIONING UNITS – VAV

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Packaged Rooftop Units

B. Unit Controls

1.2 RELATED SECTIONS

A. Section 23 0510 - General HVAC Requirements - Warranty.

B. Section 23 0513 - Motors for HVAC Equipment.

C. Section 23 0514 - Variable Frequency Controllers.

D. Section 23 0923 - Digital Control Equipment

E. Section 23 0994 - HVAC Sequence of Operation.

1.3 REFERENCES

A. ARI 210/240 - Unitary Air-Conditioning and Air-Source Heat Pump Equipment; Air-Conditioning and Refrigeration Institute; 2005.

B. ARI 270 - Sound Rating of Outdoor Unitary Equipment; Air-Conditioning and Refrigeration Institute; 1995.

C. NFPA 90A - Standard for the Installation of Air Conditioning and Ventilation Systems; National Fire Protection Association[CHOICE TEXT].

1.4 SUBMITTALS

A. Refer to Section 23 0510 - General HVAC Requirements for submittal procedures.

B. Product Data: Provide capacity and dimensions of manufactured products and assemblies required for this project. Indicate electrical service with electrical characteristics and connection requirements, and duct connections.

C. Shop Drawings: Indicate capacity and dimensions of manufacturer products and assemblies required for this project.

1. Indicate electrical characteristics and connection requirements and duct connections.

2. Provide shop drawings showing rooftop equipment curb and duct arrangement proposed by the contractor when the rooftop unit arrangement is different from the layout basis.

3. If the contractor's proposed equipment results in an arrangement different than that shown, the contractor shall coordinate structural support members beneath unit(s) with the Design Professional.

D. Manufacturer's Instructions: Indicate assembly, support details, connection requirements and include start-up instructions.

E. Operation and Maintenance Data: Include manufacturers descriptive literature, operating instructions, installation instructions, maintenance and repair data and parts listing.

F. Warranty: Submit manufacturer’s warranty and ensure that all forms have been filled out in the Owner's name and registered with the manufacturer.

G. Certificate: Provide Manufacturer's Certificate as prescribed in the General Conditions.

1.5 QUALITY ASSURANCE

A. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose specified and indicated.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Protect units from physical damage by storing off-site until roof mounting curbs are in place and ready for immediate installation.

1.7 WARRANTY

A. See Section 01 7800 - Closeout Submittals, for additional warranty requirements.

B. See Section 23 0510 - General HVAC Requirements for additional Warranty requirements.

C. Provide five-year manufacturer warranty to include coverage for refrigeration compressors.

1.8 EXTRA MATERIALS

A. See Section 01 6000 - Product Requirements, for additional provisions.

B. Provide one set of disposable panel filters at Final Inspection.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Layout Basis: Refer to the Schedule on the Drawings.

B. Acceptable Manufacturers:

1. Carrier.

2. Trane.

3. Johnson Controls, Inc.

2.2 ROOFTOP UNITS

A. Packaged single zone designed for roof mounting assembled in a housing and mounted on a full perimeter type factory fabricated steel mounting frame for flashing into the roof structure with the following:

1. Blower fan section.

2. DX cooling section.

3. Outside Air Intake/Mixed Air section

4. Economizer.

5. Filter section.

6. Condenser section.

7. Compressor section.

8. Dampers and actuators.

9. Refrigeration and temperature controls.

B. Unit shall be assembled in a housing and mounted on a full perimeter type factory fabricated steel mounting frame for flashing into the roof structure.

C. Efficiency shall meet latest Georgia Energy Code Requirements.

2.3 FABRICATION

A. Cabinet: Steel with baked enamel finish, including access panels with screwdriver operated flush cam type fasteners. Structural members shall be minimum 18 gage, with access doors or panels of minimum 20 gage.

B. Insulation: 1-inch thick insulated bottom of cabinet, and 1-inch thick fiberglass insulated sides and top of cabinet. Insulation shall be neoprene coated glass fiber with edges protected from erosion.

C. Supply Fan: Forward curved centrifugal type, resiliently mounted with V-belt drive, adjustable variable pitch motor pulley, and rubber isolated hinge mounted high efficiency motor . Isolate complete fan assembly.

D. Air Filters: 2-inch thick disposable, extended area panel filters. Refer to Section 23 4000.

E. Roof Mounting Curb:

1. Mounting frame shall be approved by the National Roofing contractors Association and shall have curb-to-unit base gasket with air tight fit.

2. 14 inches high insulated galvanized steel, channel frame with gaskets, nailer strips.

3. Provide roof curb isolation. Refer to section 23 0548.

F. Drain Pan: Condensate drain pans shall be water tight welded stainless steel pitched for flow to drain connection. Pan shall be insulated with 1/2-inch thick minimum closed cell rigid foamed insulation secured with waterproof adhesive, foamed in place or 1-inch rigid board with two coats of Spray Cor.

G. Casing or protective guard shall protect condenser coil return bends and fins from damage.

2.4 EVAPORATOR COIL

A. Multiple-circuited DX evaporator coils of aluminum finned copper tubes, connected to a condensing unit section containing vibration isolated hermetic motor compressor(s), crankcase heater, discharge temperature limiter, current and temperature sensing motor overloads, condenser fans and coil.

B. Coils shall be sized for maximum of 500 FPM face velocity.

2.5 COMPRESSOR

A. Provide hermetic compressors, 3600 rpm maximum, resiliently mounted with positive lubrication, crankcase heater, high and low pressure safety controls, motor overload protection, suction and discharge service valves and gage ports.

B. Five minute stop to restart circuit to delay compressor start.

2.6 REFRIGERANT CIRCUIT

A. Provide each unit with two independent refrigerant circuits, factory supplied and piped.

B. For each refrigerant circuit, provide:

1. Filter dryer .

2. Liquid line sight glass and moisture indicator.

3. Thermal expansion valve for maximum operating pressure.

4. Insulated suction line.

5. Charging valve.

2.7 MIXED AIR SECTION

A. Dampers (Return Air/Outside Air Section): Provide control dampers required for economizer operation with relief through unit. Dampers shall be low leak type with maximum leakage of 4 cfm/sq. ft. at 1-inch pressure difference.

2.8 SAFETY CONTROLS

A. Provide safety controls arranged so any one will shut down unit and require manual reset:

1. High discharge pressure switch for each compressor.

2. Low suction pressure switch for each compressor.

3. Oil pressure switch.

2.9 OPERATING CONTROLS

A. General: Unit control system shall be a factory-supplied electronic integrated system with equipment manufacturer solely responsible.

B. Locate controls in a NEMA ICS 6 weatherproof steel control cabinet separated from power wiring and other components. Provide an LED display indicating the status of all serial wiring and other components. Provide an LED display indicating the status of all serial communication, error messages, power status, and all digital output and analog input points.

C. Automatic dry bulb economizer shall position automatic OA/RA dampers to maintain space temperature when outdoor dry bulb is 60 degrees or less.

D. RTU start-Stop: The BAS system shall provide a signal to start-stop the RTU.

E. Variable Air Volume:

1. Factory provided unit controller cycles DX cooling coil and compressors, actuates economizer cycle and electric heating coil to maintain supply air temperature setpoint of 55 degrees.

2. Supply fan modulation: Provide a variable frequency controller meeting the requirements of Section 23 0514 to modulate fan based on signals from a duct mounted static pressure sensor.

3. Minimum outside air: The BAS system shall provide a signal indicating the building is occupied. The RTU controls shall open the normally closed outdoor air dampers and modulate the damper proportional between maximum and minimum positions based on supply air fan speed. Set maximum and minimum damper positions during test and balance.

F. Furnish BACNET communication interface with the BAS.

2.10 POWER WIRING

A. Locate power wiring in a NEMA ICS 6 weatherproof steel cabinet separated from controls and other components.

B. Provide through the base electrical access for both main power and control power connections inside the curb and through the base of the unit.

C. Provide factory wired units with a single point of electrical connection.

D. Provide across-the-line starter, non-recycling compressor overload, starter relay for each compressor. Provide manual reset current overload protection.

E. Provide starter relay for each condenser fan and motor with built-in overload protection.

F. Provide a surge capacitor and lightning arrestor in starter cabinet for protection from power surges due to lightning and switching transients.

G. Ground shall be #6 A.W.G. Provide separate driven ground for ground mounted and connect to building steel for roof mounted units.

H. Provide motor protector.

I. Control Power Transformers: 120 volt secondary. 45 VA minimum. Provide fused primary, secondary, and bond unfused leg of secondary to enclosure.

J. Disconnect Switch: Factory mount disconnect switch on power cabinet. Switch shall be accessible without the use of tools.

K. Receptacle: Provide prewired GFI protected 120 volt service power receptacle.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that roof is ready to receive work and opening dimensions are as indicated on shop drawings.

B. Verify that proper power supply is available.

3.2 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Route copper evaporator condensate piping, full size, thru trap as detailed on Drawings to the nearest active roof drain or gutter.

C. Mount units on factory built roof mounting curb providing watertight enclosure to protect ductwork and utility services.

D. Mount roof mounting curb level.

3.3 STARTING EQUIPMENT

A. Provide manufacturer's field representative to prepare and start equipment.

B. Adjust for proper operation within manufacturer's published tolerances.

C. Demonstrate proper operation of equipment to the Owner 's designated representative.

D. Provide start-up certificate as prescribed in the General Conditions.

3.4 SCHEDULES

A. Capacities shall not be less than scheduled at 95 F ODT.

B. Total GTH and Sensible capacities shown are the minimum. Leaving dry bulb shall not be higher than scheduled value.

C. Refer to the Schedule on Project Drawings.

END OF SECTION

SECTION 26 0505 - SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical demolition.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify field measurements and circuiting arrangements.

B. Verify that abandoned wiring and equipment serve only abandoned facilities.

C. Demolition drawings are based on casual field observation and existing record documents.

D. Report discrepancies to the Design Professional before disturbing existing installation.

E. Beginning of demolition means installer accepts existing conditions.

3.2 PREPARATION

A. Disconnect electrical systems in walls, floors, and ceilings to be removed.

B. Coordinate utility service outages with Owner if building is to remain occupied during demolition.

C. Coordinate utility service outages with utility company.

D. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.

E. Fire Alarm System: Where a required fire alarm system is out of order for more than 4 hours in a 24 hour period, the Owner shall be notified, and the building shall be evacuated or an approved fire watch shall be provided for all parties left unprotected by the shutdown until the fire alarm system has been returned to service.

3.3 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

A. Remove, relocate, and extend existing installations to accommodate new construction.

B. Remove abandoned wiring to source of supply.

C. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

D. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.

E. Disconnect and remove abandoned panelboards and distribution equipment.

F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

G. Disconnect and remove abandoned luminaires. Remove brackets, stems, hangers, and other accessories.

H. Repair adjacent construction and finishes damaged during demolition and extension work.

I. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.

J. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.4 CLEANING AND REPAIR

A. Clean and repair existing materials and equipment that remain or that are to be reused.

B. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 0510 - GENERAL ELECTRICAL REQUIREMENTS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Definitions

B. Quality Assurance Requirements and Installer Qualifications.

C. Submittal Procedures

D. Execution Requirements common to Division 26 systems

E. Equipment bases and housekeeping pads

1.2 DEFINITIONS

A. Manufacturer's Representatives: Wherever MANUFACTURER'S REPRESENTATIVE is referred to in this division, said representative shall be regularly employed by the manufacturer to perform similar activities to those called for herein, which indicates his competence in that field of work.

B. Concealed: Where the word concealed is used in this Division, it shall mean items above ceilings, in attics, in crawl spaces, in chases, in tunnels, in cabinet work, and under counters or equipment so as to be not visible from an elevation of 5 feet at a horizontal distance of 10 feet.

C. Finished Spaces or Areas: Where finished spaces or areas are referred to in this Division, it shall mean all spaces except concealed spaces, mechanical rooms, or boiler rooms unless otherwise noted.

D. Provide: Where the word provide is used, it shall mean to furnish and install the item(s) in accordance with plans, specifications or manufacturer's instructions.

E. Control and Interlock Wiring: All wiring, both line voltage and low voltage, other than power wiring from an electrical distribution panel, through the primary control device, to the equipment.

F. Primary Control Device: That ONE device for any item of equipment which interrupts power flow during normal operation. Where magnetic starters are provided, they are the primary control. For items not switched by starters, the primary control device will be the ONE thermostat, manual switch, aquastat, P.E. switch, or relay performing the primary switching.

G. Diagrammatic: A drawing that shows arrangement and relations (as of parts).i.e.: A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and is not necessarily to scale. Arrangement, location, and sizes shown are firm.

H. Readily Accessible: Equipment, valves and other items requiring service shall be installed to be readily accessible. These items shall be available for maintenance or use in a space, through an access door from floor elevation, or above a lay-in ceiling by maintenance staff standing on a ladder no taller than the ceiling.

I. Noted, Indicated or Shown: Where the terms "Noted", "Indicated" or "Shown" are used in these specifications, the words "in the specifications or on the plans" shall be inferred.

J. Detail: Details referenced shall pertain to plans unless otherwise noted.

K. Specifications: Where reference is made to these specifications, it shall be inferred in this Division of specifications.

L. Notification by the Contractor, and Instructions to the Contractor: Where reference is made in these specifications to notification by or instructions given to the Contractor, it shall be inferred that the Design Professional shall be the notifier or the instructor as the case exists.

M. Submittal Data, Equipment Cuts, Shop Drawings: Wherever these terms are used in the plans or specifications, the information is to be submitted for review as part of the packaged submittal specified under "SUBMITTALS".

N. Conduit of Duct Bank: Two or more, 2-inch or larger conduits with a common point of origin and a common point of termination routed parallel, and as specifically designated on plans.

O. See Article 100 of the 2023 National Electrical Code with all Georgia State Amendments.

P. Division or Section Reference: Where reference is made to another Division or Section within this Division, refer to specifications table of contents for Division, Section, or Page Number.

Q. Diagrammatic: A drawing that shows arrangement and relations (as of parts). A diagrammatic drawing uses symbols rather than pictorial representation of pipes, ducts, conduit and other items shown and are not necessarily to scale. Arrangement, location and sizes shown are firm.

R. Horizontal Cabling: A data cabling term indicating the cable from the work area back to the patch panel. Commonly used in the description "conduit for horizontal cabling shall be 1" minimum in size".

1.3 REGULATORY REQUIREMENTS

A. General: Where requirements of these specifications exceed specified codes and ordinances, conform to these specifications.

B. Materials and equipment included in Underwriters Label Service shall bear that label. Electrical equipment shall be U.L. approved as installed.

C. Jurisdiction: Where codes or guides refer jurisdiction to local governing code officials, such official in this procedure shall be the State Fire Marshal.

D. Permits: Permits and licenses of a temporary nature necessary for the prosecution of the work shall be obtained and paid for by the Contractor. Neither the Contractor nor any sub-contractor will be required to pay Municipal or County building permit fees. The Contractor and/or any subcontractor will be required to pay any Municipal and/or County building license taxes or fees, if any.

E. Energy: Conform to the International Energy Conservation Code, 2015 Edition, with all Georgia State Amendments.

F. All Work: Conform to State of Georgia Chapter 120-3-3 "Rules of Safety Fire Commissioner, Rules and Regulations, January 1, 2018", and ADA.

G. Fire Prevention: Conform to Georgia State Minimum Standard Fire Prevention Code (International Fire Code), 2018 Edition, with all Georgia State Amendments.

H. Building Code: Conform to the Georgia State Minimum Standard Building Code (International Building Code), 2018 Edition with all Amendments.

I. Electrical: Conform to the 2023 National Electrical Code (NEC), NFPA, and the National Electrical Safety Code.

J. Life Safety: Conform to the 2018 Edition of NFPA 101 - Life Safety Code, with Georgia State Amendments.

K. Fire Alarm: Conform to the 2019 Edition of NFPA 72 - National Fire Alarm Code, with Georgia State Amendments.

1.4 PERFORMANCE REQUIREMENTS

A. Requirements specified herein are minimum. All equipment, when installed, shall perform equal to or exceed specified requirements.

1.5 SUBMITTALS

A. In general, the design professional is allocated 14 calendar days to review a submittal. On large items such as gear, panel, and lighting submittals, our office will require this same amount of time, and should receive copies of these submittals at the same time as the design professional. Special circumstances may require faster turnaround times, and may be discussed at the onset of the submittal process.

B. Supplementing Division 1 requirements; the Contractor shall:

1. Review the submittal data and check to ensure compliance with specifications prior to submitting.

a. The Contractor agrees that submittals of equipment and material and shop drawings of equipment and material layouts required under provisions of these specifications and processed by the Architect are not Change Orders.

b. The purpose of submittals is to demonstrate that the Contractor understands the design concept of the project by indicating the equipment and materials he intends to furnish and install, and by detailing the installation he intends to achieve. The review by the Design Professional shall NOT be construed to be for the purpose of "approving" equipment or drawings. The plans and specifications alone are the contract document. The contractor has agreed to follow the contract document, regardless of the results of the submittal submission.

c. The Contractor shall conform to the requirements of the Contract Documents unless a change order or a specific letter of clarification is issued. The Contractor shall identify on each submittal and in letter form to the Design Professional any and all deviations from the Contract Documents.

d. Any submittal or shop drawing not conforming to the Contract Documents without this identification and notification shall be assumed to be marked "Revise and Resubmit" (the Contractor acknowledges this by the submission), and the Contractor shall promptly resubmit said submittal so as to be in full compliance with the Contract Documents.

e. Failure of the Contractor to provide this information during the shop drawing phase shall make the Contractor responsible for all changes to achieve compliance with the Contract Documents without additional compensation.

2. Assemble the submittal data in compete sets in hard back three-ring binders, separated by trade, and bound with numbered index sheets and tabs. Submittal data shall be submitted at one time unless unavailable data such as control submittal would delay project progress.

3. Identify all submittals by a cover sheet showing project name, specification sections, drawing or detail number, room number, date, revision date, the Contractor and subcontractor's organization and project manager with phone number, the model, style and size of item being submitted with manufacturers' representative, salesman (or a preparer who can answer questions), and preparer's phone number.

4. Manufacturers' standard drawings shall be modified by deletions or additions to show only items applicable to this project.

5. Prepare a master list of submittals proposed to be submitted on the project. This list shall be updated for each submission and shall be the first sheet(s) of the submission in the quantity that is submitted for review. The information and general format shall contain an Tab number, Item Description, Item Status and any comment. Items that require quicker submittal review because of material lead times should be indicated in this list.

6. Provide a Letter stating that all submittals have been checked for compliance with specifications.

7. Deliver submittals to the Architect at the business address.

8. Paperless Delivery of Submittal:

    a. Submittal data may be posted to NBP's FTP site when agreed upon by the Design Professional and the Owner during preconstruction. The Contractor will be provided with a project folder and password.

    b. Prepare the submittals as described above. Take steps to reduce submittal file size.

    c. Do not scan in color or high resolution unless needed for clarity.

    d. Ensure any reproduction are legible.

    e. Send an email to submittal@nbpengineers.com with a copy to the Electrical Design Professional and the Architectural Design Professional identified during the preconstruction phase.

    f. Identify the submittal in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administration Building Section 26 0534- Conduit.

    g. Ensure the submittal posted to the FTP site has the same identification.

    h. NBP Design Professionals will not process or react to submittals not properly sent or identified.

C. Power Wiring Requirements: The Contractor shall submit a letter acknowledging receipt and review of the Tabulated List of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of the Specifications. Failure to submit this letter will require the Contractor to assume responsibility for any required changes to the electrical design attributed to mechanical equipment. Include a copy of the Tabulated List of Power Wiring Requirements with the letter. The electrical requirements for the mechanical equipment is based on the best information available at the time of design. The Contractor is responsible for coordinating with the purchased equipment. Power Wiring letters are required for the following equipment:

1. Mechanical

1.6 OPERATING AND MAINTENANCE MANUALS

A. Each Manual shall be compiled as follows:

1. Data shall be bound in smooth surface hard back commercial quality three-ring notebooks with project identification shown on the front cover and binding back. Identification labels shall be typed and adhered with waterproof glue.

2. Notebooks shall have 9-1/2-inch by 11-1/2-inch covers with back width to permit the covers to lie parallel or to converge, and have not less than 1-1/2-inch back width.

3. Index divider sheets of heavy Manila paper shall be inserted between each section of the Manual with a 2-inch x 1/3-inch ready-cut shield tab attached to each sheet for identification of sections.

4. Data sheets and diagrams shall be 8-1/2-inch x 11-inch or be mounted on 8-1/2-inch x 11-inch sheets of 16-pound paper if smaller, with reinforced 11-inch mechanically perforated edges. Drawings and diagrams larger than 8-1/2-inch by 11-inch shall be folded up from the bottom to form a height of 11-inches and folded to the left to form a width of 8-1/2-inches.

5. Table of Contents(Index) sheets shall be provided in the order listed with identifications typed in capital letters.

B. Digital delivery of Operating and Maintenance Manuals:

1. Operating and Maintenance Manuals may be delivered digitally and posted to the NBP Engineers FTP site when agreed upon by the Design Professional and the Owner during the preconstruction phase. The Contractor will be provided with a project folder and password.

2. Prepare the Operating and Maintenance Manuals as described above. Take steps to reduce submittal file size.

3. Do not scan in color or high resolution unless required for clarity.

4. Ensure any reproductions are legible.

5. Send an email to submittal@nbpengineers.com with a copy to the Electrical Design Professional and the Architectural Design Professional identified during the preconstruction phase.

6. Identify the manuals in the email subject line using the official project title, specification section and submitted item. I.E. Project No. G-xxx, Addition to Administrative Building.

7. Table of Contents(Index) sheets shall be included in the order listed with identifications typed in capital letters.

8. Ensure the manuals posted to the FTP site has the same identification.

9. NBP Design Professionals will not process or react to manuals which are not properly transmitted, indexed, and identified.

C. Each Manual shall contain the following information, data and drawings:

1. Copies of approved submittals (with Design Professional's review comments and stamp), equipment and materials.

2. Manufacturer's installation, operating and maintenance instructions for each item of equipment.

3. Manufacturer's list of renewal parts for each item of equipment with recommended stock items and quantities indicated.

4. Control diagrams.

5. Wiring diagrams and color codes for fire alarm system. Refer to fire alarm specifications.

6. Copies of shop drawings showing layouts and construction details. Shop drawings are required for the following systems:

   a. Lighting control (occupancy sensor, dimming and relay panels)

7. Testing Results: Coordination Study, final settings on all adjustable breakers.

8. Provide a copy of the riser diagram, no smaller than printed on 11X17, with lengths of feeders shown (handwritten is acceptable).

9. Maintenance schedules.

10. Warranty Information.

11. Sign in sheets for all owner training sessions.

1.7 QUALITY ASSURANCE

A. Electrical Installer's Qualifications:

1. General: Wherever the word "Sub-Contractor" or "Firm" is used in these subparagraphs, it shall mean the Contractor/sub-contractor of record for the installations used for proficiency qualification.

2. Warranty of Contractor: The Contractor shall warrant that the Firm(s) selected by him are reputable, skilled, reliable, competent, qualified in the trade or field in which they are to perform on the project, and thoroughly familiar with applicable codes and standards.

3. Location: The firm which performs the installation of the work under this section shall be one who maintains an established, experienced organization with a permanent, manned office. See General Conditions.

4. Experience: The firm's proficiency in the installation and adjustment of Electrical systems shall have been demonstrated by the successful performance of work as specified herein on at least three commercial, hospital or institutional buildings with a minimum floor area of 25,000 square feet, 480 volt, 1200 amps, 3 phase service entrance.

5. The firm shall have been in business performing services as specified herein for at least 3 years.

B. Activity Log Book:

1. A Log Notebook of tear-out sheet type, with consecutively numbered pages shall be maintained on site by the Project Superintendent providing a continuous record of tests, equipment start-up, system start-up/check out for the length of the project.

2. Notebook entries shall include data; description of test/check out; sub-contractor involved; personnel involved; and results.

3. The Contractor shall turn over original notebook and two (2) first generation copies to the Design Professional at final inspection.

C. Substitutions:

1. All costs incurred by acceptance of substitutions shall be borne by the Contractor. Should any proposed substitute equipment require services in addition to or in excess of services provided in the Contract Documents, these services shall be provided at no extra cost to the Owner.

2. Request for approval of a proposed product (substitution) shall be accompanied by the schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the Contract Documents and from the design intent. If there are no deviations or changes required to the design, the submittal shall be accompanied by the following statement: "The proposed material or equipment submitted for approval requires no changes to the Contract Documents to achieve the design intent." Lack of the schedule or statement will result in automatic disapproval of the request.

3. Facsimile (Fax) Requests for prior approval will not be considered due to the inability of the sender being able to assure that information sent was information received and possible poor clarity of the fax, and the short time period for review and response.

D. Architectural And/or Structural Requirements:

1. Refer to the specifications and Architectural and Structural drawings for additional requirements pertaining to work under this discipline. Notify the Design Professional if conflict for clarification.

1.8 WARRANTY

A. Refer to Section 01 7000 - Project Closeout for additional warranty requirements.

B. Where extended warranties beyond the Contractor's one (1) year warranty are specified, the additional warranty time shall start at the end of the Contractor's warranty.

C. Correct defective Work within a one year period after Date of Material Completion.

1.9 NOTIFICATION TO THE OWNER WHEN THE CONTRACTOR VISITS SITE AFTER FINAL INSPECTION

A. When the Contractor's representative visits the job after the final inspection to perform specific work such as maintenance service, seasonal balance, or to correct a deficiency, the Contractor shall notify the Owner not less than 48 hours prior to the date on which they will visit the site, except under an emergency condition.

B. The Contractor shall visit the designated office of the Owner to notify the Owner that the Contractor is on the site prior to visiting the site, thereby enabling the Owner's representative to accompany the Contractor, should they so desire while the Contractor is on the project site.

C. A carbon copy of the notification shall be provided to the Design Professional with the intent of the site visit. After the Contractor has completed the site visit, the Contractor shall give a written report of the action taken and any incomplete work yet to be performed to the Design Professional, within five (5) days.

1.10 ABBREVIATIONS - ELECTRICAL

AIC	AVAILABLE INTERRUPTING CAPACITY
A.F.F.	ABOVE FINISHED FLOOR
AL	ALUMINUM
ANT	ANTENNA
AWG	AMERICAN WIRE GAUGE
B.E.	BOTTOM ELEVATION
B.G.	BELOW FINISHED GRADE
BRKR	BREAKER
C	CONDUIT
CAT.	CATALOG
CLG	CEILING
C.O.	CONVENIENCE OUTLET
COND.	CONDUCTOR(S)
CU	COPPER
D.	DIAMETER
EMER	EMERGENCY

EMT	ELECTRICAL METALLIC TUBING
F.O.	FIBER OPTIC
FAP	FIRE ALARM PANEL
FUT	FUTURE
GND	GROUND
H-O-A	HAND-OFF-AUTO
HTR	HEATER
I.A.W.	IN ACCORDANCE WITH
IMC	INTERMEDIATE METALLIC CONDUIT
MB	MAIN BREAKER
MFGR	MANUFACTURER
MLO	MAIN LUGS ONLY
MTD	MOUNTED
MTG	MOUNTING
N.E.C.	NATIONAL ELECTRICAL CODE (2023)
NFDS	NON FUSED DISCONNECT SWITCH
N.I.C.	NOT IN CONTRACT
NMC	NON METALLIC CONDUIT
NO.	NUMBER
PLCS	PLACES
PVC	POLYVINYL CHLORIDE
R.	RADIUS
R.G.S.	RIGID STEEL CONDUIT
SCHED.	SCHEDULE
SEC.	SECTION
SMR	SURFACE METAL RACEWAY

SURF.	SURFACE
SYM	SYMMETRICAL
TEL.	TELEPHONE
TYP.	TYPICAL
W/	WITH
WP	WEATHERPROOF
XFMR	TRANSFORMER
20A/3P	20 AMP / 3 POLE TYPICAL

PART 2 PRODUCTS

2.1 TRADE NAMES

A. When reference is made in the contract documents to trade names, brand names, or to the names of manufacturers, such references are made solely to indicate that products of that description may be furnished and are not intended to restrict competitive bidding. If it is desired to use products of trade or brand names or of manufacturer's names which are different from those mentioned in the contract documents, application for the approval of the use of such products must reach the hands of the Architect at least ten days prior to the date set for the opening of the bids. The latter provision is a restriction which applies only to the party making a submittal. Therefore, the aforesaid restriction does not inhibit the Contractor from adding trade names, brand names, or names of manufacturers by addendum.

B. The burden of proving acceptability of a proposed product for use in place of a product or products designated by trade names or names, brand name or names, or by the name or names of manufacturers in the contract documents rests on the party submitting the request for approval. The written application for approval of a proposed product must be accompanied by technical data which the party requesting approval desires to submit in support of is application.

C. The Architect will give consideration to reports from reputable independent testing laboratories' verified experienced records showing the reputation of the proposed product with previous users, evidence of reputation of the manufacturer for prompt delivery, evidence of reputation of the manufacturer for efficiency in servicing its products, or any other written information that is helpful in the circumstances. The application to the Design Professional for approval of a proposed product must be accompanied by a schedule setting forth in which respects the materials or equipment submitted for consideration differ from the materials or equipment designated in the contract documents. The degree of proof required for approval of a proposed product as acceptable for use in place of a named product or named products is that amount of proof necessary to convince a reasonable person beyond all doubt.

D. To be approved, a proposed product must also meet or exceed all express requirements of the contract documents. If the submittal is approved by the Design Professional, an addendum will be issued to all prospective bidders. Issuance of an addendum is a representation to all bidders that the Design Professional in the exercise of his professional discretion established that the product submitted for approval is acceptable and meets or exceeds all express requirements. In the event a submittal shall have been rejected by the Design Professional and there shall have been a request for a conference as provided in the article pursuant to which conference the said submittal shall have been found to comply with the requirements of this article, a separate addendum covering the said submittal will be issued prior to the opening of the bids.

E. In order for the Design Professional to prepare an addendum intelligently, an application for approval of a product must be accompanied by a copy of the published recommendations of the manufacturer for the installation of the product together with a complete schedule of changes in the drawing and specifications, if any, which must be made in other work in order to permit the use and installation of the proposed product in accordance with the recommendations of the manufacturer of the product. Unless request for approval of other products have been received and approvals have been published by addendum in accordance with the above procedure, the successful bidder may furnish no products of any trade names, brand names, or manufacturer's names except those designated in the contract documents.

F. Any party who alleges that rejection of a submittal is a result of bias, prejudice, caprice, or error on the Design Professional may request a conference with a representative of the owner provided that the request for said conference, submitted in writing, shall have reached the owner at least five days prior to the date set for the opening of the bids, time being of the essence.

PART 3 EXECUTION

3.1 EXAMINATION

A. Hazardous Materials:

1. A/E's Responsibility: Plans and specifications have been prepared by the A/E for the Owner without the A/E having conducted investigation as to the presence of asbestos or hazardous waste on the project. Not being a part of this contract, the A/E has not charged any fees and has not and will not advise the Owner with regard to the detection and/or removal of asbestos or hazardous waste. The Owner is aware that asbestos or hazardous waste could be present and will make all decisions with regard to its removal. The removal of all hazardous materials and encapsulation of remaining surfaces is the sole responsibility of the Owner.

2. If the Contractor observes the existence of a friable material which must be disturbed during the course of his work, the Contractor shall promptly notify the Owner and the Design Professional. The Owner shall make all arrangements regarding testing and removal or encapsulation of asbestos material if present. The Contractor shall not perform

any work pertinent to the friable material prior to receipt of special instructions from the Owner through the Design Professional.

3. "Friable Material" is any material which can be crumbled, pulverized or reduced to a powder by hand pressure when dry.

B. Asbestos (ACBM)

1. Specifications written for equipment and materials in this division of the specifications are intended to eliminate any asbestos containing substance. The Contractor and his suppliers are hereby notified that NO ASBESTOS CONTAINING PRODUCT IS PERMITTED. If a product is listed in these specifications which contains asbestos, the Contractor and his supplier shall so inform the Design Professional immediately and shall not deliver such product to the project site until additional written instructions are received.

2. Upon completion of construction, and prior to final inspection, the Contractor for work performed under this division of the specifications shall be required to provide a certificate to the Design Professional in the following form:

CERTIFICATION FOR ASBESTOS CONTAINMENT

I/we _____(Sub-Contractor), certify that there is no asbestos contained in materials provided and/or installed by us in_____ _____(Project/Building).

WITNESS _____(Notary Public) DATE:_____

CONTRACTOR:_____

_____

BY: _____

TITLE: _____

3.2 PREPARATION

A. Drawings are diagrammatic and show the general location of the equipment, raceway, and equipment, but are not to be scaled. All dimensions shall be verified at the building site. Prefabrication and/or installation of work from drawings shall be at the Contractor's risk. Refer to Architectural plans for exact building dimensions and details.

B. Space Conditions:

1. All apparatus shall fit into the available spaces in the building and must be introduced into the building so as not to cause damage to the structure. Equipment larger than access to equipment spaces shall be disassembled into sub-assemblies for installation.

2. Where deviations from the plans are required in order to conform to the space limitations, such changes shall be made at no additional cost to the Owner and shall be subject to approval.

3. All equipment requiring service shall be made accessible.

C. Where new work is specified or shown connected to old work and materials are different from existing, the Contractor shall request a clarification from the Design Professional prior to performing the work.

D. The demolition plan has been prepared to assist the Contractor in determining the scope of demolition work and should not be construed to be all of the demolition required. The Contractor shall visit job site (after carefully reviewing the contract documents) and determine exact areas and quantities of existing materials to be removed to accomplish new construction.

3.3 INSTALLATION

A. All equipment shall be installed in accordance with manufacturer's published installation instructions shipped with the equipment. In the event there is a discrepancy between these specifications or Drawings and the manufacturer's instructions, no work shall be performed until additional instructions are received.

B. Route conduits and cable trays to avoid skylights, translucent, and transparent ceilings.

C. Cutting and patching in connection with the installation shall be done by the trade whose work is to be cut. The Contractor shall lay out and install his work ahead of the work of other trades wherever possible.

D. Where penetrations are made in fire rated partitions, walls, floors or ceilings during the course of electrical installation, these penetrations shall be restored to their intended fire ratings by the use of fittings or materials as approved by Underwriter's Laboratories for this purpose.

E. See General Conditions.

F. Fire Prevention Precautions in Cutting and Welding Areas: Conform to Article 2904 Fire Prevention Precautions, Georgia State Minimum Standard Fire Prevention Code (International

Fire Code), 2012 Edition, with all Georgia State Amendments for all work involving cutting and welding.

G. Seal sleeves and openings in exterior walls and mechanical room walls vaportight, watertight, or for smoke/fire protection as applicable. Refer to Section 07 8400 - Firestopping.

H. Record Drawings:

1. After completion, any changes in the location of conduits, the connections of circuits, or any other changes from the contract documents shall be noted on a clean set of blue line white prints and delivered to the Design Professional before final acceptance of work.

3.4 INTERFACE WITH OTHER WORK

A. General: No roughing shall be done until roughing drawings and exact electrical demand of equipment is obtained. Notify the Design Professional of any discrepancies.

B. Mechanical:

1. Review Tabulated List of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of the specifications. Conduit, conductor and breaker sizes shown for mechanical equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical circuits compatible with the proposed mechanical equipment where the mechanical equipment conforms to Division 23 of the specifications, but does not conform to the electrical criteria of these contract documents . The Contractor shall submit the proposed electrical modifications to the Design Professional for review prior to roughing. No additional costs to the contract will be allowed for these modifications.

2. Provide control, program and interlock wiring as shown on Mechanical and/or Electrical drawings.

3. Provide conduit, wiring, boxes, adaptors for equipment terminations and disconnect switches. Provide power wiring through primary control device.

4. Starters, push-button stations, contactors, relays, limit and safety devices, and control items are specified in Division 26 of the specifications (except as shown in Motor Control Center). Unless otherwise noted, all starters shall be mounted between 24" and 80" above finished floor. Push-button stations shall be mounted at switch height except as noted.

5. Owner Furnished Equipment: Provide conduit, wiring, boxes, adaptors for equipment terminations, and disconnect switches. Make all connections indicated.

6. The information shown on the plans is based upon the best available information. Before performing any work on the site, the Contractor shall contact the utility company(s) serving the facility and stake out all underground services. Notify the Design Professional of any discrepancies.

3.5 EQUIPMENT BASES AND HOUSEKEEPING PADS

A. Provide housekeeping and equipment pads where penetrations occur through any slab ON OR ABOVE GRADE in the electrical and data rooms. All electrical items that sit on the slab shall have housekeeping pads below. Rough up slab under bases before pouring concrete.

B. Materials: Refer to Section 03 3000 - Cast-in-Place Concrete. Omit test cylinders for concrete poured under this section.

C. Bases/Pads shall be rectangular with vertical sides 4 inches from centerline of anchor bolts or 2 inches from edges of equipment supports, whichever provides the larger dimension, side of equipment or base edge, unless otherwise noted. Housekeeping pads shall be minimum 4 inches thick.

D. Radius Edge: 3/4 inch on edges and corners.

E. Reinforcing: 6"x 6" 10/10 WWF at mid-depth of slab. (4 inch thick pads.)

3.6 STARTING EQUIPMENT AND SYSTEMS

A. Adjust equipment for proper operation within manufacturers' published tolerances.

B. Demonstrate proper operation of systems and equipment to the Owner 's designated representative.

3.7 DEMONSTRATION, TRAINING AND INSTRUCTIONS

A. Instructions:

1. Instruct operating personnel designated by the Owner in operation and maintenance of systems prior to the request for final inspection. A manufacturer's service representative shall provide the instructions for each piece of equipment on system. A manufacturer's sales representative is not acceptable. (Instructor shall not be a sales person, but shall be one with service experience on a continuing basis, knowledgeable about the subject equipment.) The Owner will record (audio or video/audio) operating instructions given by the contractor to the operating personnel. Training shall be given on the following equipment:

    a. Lighting Control System - 4 hrs.

2. The Contractor shall give notice to the Design Professional not less than 60 days of the anticipated date of instruction to allow planning by the Owner.

3. The Contractor shall request the instruction date not less than 15 days of the desired date for coordination with the Owner. Operating manuals for the equipment/systems on which instructions are being given shall be in the possession of the operating personnel not less than 30 days prior to the date of instruction.

4. The Contractor shall give an orientation session to operating personnel for achieving familiarity (not instructions) of the systems approximately 5 days prior to the instruction date. The Contractor's representative giving instruction shall be knowledgeable in the equipment/systems to allow quality recordings by the Owner.

5. Provide a signed statement from operating personnel certifying orientation and instructions have been received. Provide typed sequence of operation to be inserted in the maintenance manuals.

B. Completion of Work:

1. At final observation a test shall be made and the entire system shall be shown to be in working condition. The following shall be made available to personnel conducting the test:

a. Electrician with hand tools.

b. Accurate Voltmeter.

c. Clamp on Ammeter.

d. Test Lamp.

e. Phase Rotation Indicator.

f. Complete Electrical Specifications and Drawings with all addenda and revisions.

g. Pre-final Punch List indicating disposition of all items with initials of person confirming completion.

2. Before final observation or at final observation, the Contractor shall present the following to the Design Professional:

a. Finalized and corrected maintenance manuals.

b. Special systems certificates.

c. Record marked-up drawings.

d. Required test results.

3.8 CLEANING and PROTECTION

A. All materials, equipment and electrical/telecommunications rooms shall be cleaned prior to Final Observation.

B. Remove any stored materials. Vacuum interiors of all panelboards, switchboards, switchgear, transformers and any other electrical equipment.

C. Paint equipment where finish has been damaged requiring retouching of finish to match factory finish. Equipment which has been damaged beyond the point of retouching or has been retouched not to match shall be repainted to match factory finish.

D. Chipped or scraped paint shall be retouched to match original finish.

E. All equipment shall be free of dust, rust and stains prior to substantial completion.

F. During Construction: Conduit openings shall be closed with caps or plugs. All equipment shall be covered and protected against water, dirt and chemical or mechanical injury. All equipment and material shall be stored in accordance with manufacturer's recommendations.

3.9 FINISHING ELECTRICAL EQUIPMENT AND MATERIAL

A. Use paint systems specified in Division 9 for the substrates to be finished.

B. Paint conduit and electrical equipment in exposed, public areas per the Design Professional's instructions.

C. All ferrous fasteners and hanger supports not having a corrosion resistant plated finish shall be painted to prevent rust.

D. Paint all equipment, including that which is factory-finished, exposed to weather or to view on the roof and outdoors.

END OF SECTION

SECTION 26 0519 - LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Single conductor building wire.

B. Wire and cable for 600 volts and less.

C. Wiring connectors.

D. Electrical tape.

E. Wire pulling lubricant.

F. Cable ties.

1.2 RELATED REQUIREMENTS

A. Section 07 8400 - Firestopping.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.

C. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

B. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.

C. Field Quality Control Test Reports.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.1 CONDUCTOR AND CABLE APPLICATIONS

A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.

B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.

C. Nonmetallic-sheathed cable is not permitted.

D. Underground feeder and branch-circuit cable is not permitted.

E. Service entrance cable is not permitted.

F. Armored cable is not permitted.

G. Metal-clad cable is permitted only as follows:

1. Where not otherwise restricted, may be used:

a. Where concealed in hollow stud walls and above accessible ceilings for branch circuits.

2. In addition to other applicable restrictions, may not be used:

a. Where not approved for use by the authority having jurisdiction.

b. Where exposed to view.

c. Where exposed to damage.

d. For damp, wet, or corrosive locations, unless provided with a PVC jacket listed as suitable for those locations.

2.2 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

A. Provide products that comply with requirements of NFPA 70.

B. Provide products listed, classified, and labeled as suitable for the purpose intended.

C. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.

D. Comply with NEMA WC 70.

E. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.

F. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.

G. Conductor Material:

1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.

2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B 787M unless otherwise indicated.

H. Minimum Conductor Size:

1. Branch Circuits: 12 AWG.

a. Exceptions:

1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.

2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.

3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.

I. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

J. Conductor Color Coding:

1. Color code conductors as indicated. Maintain consistent color coding throughout project.

2. Color Coding Method: Integrally colored insulation.

3. Color Code:

a. 480Y/277 V, 3 Phase, 4 Wire System:

1) Phase A: Brown.

2) Phase B: Orange.

3) Phase C: Yellow.

4) Neutral/Grounded: Gray.

b. 208Y/120 V, 3 Phase, 4 Wire System:

1) Phase A: Black.

2) Phase B: Red.

3) Phase C: Blue.

4) Neutral/Grounded: White.

c. Equipment Ground, All Systems: Green.

d. Isolated Ground, All Systems: Green with yellow stripe.

2.3 SINGLE CONDUCTOR BUILDING WIRE

A. Manufacturers:

1. Copper Building Wire:

a. Cerro Wire LLC: www.cerrowire.com/#sle.

b. Encore Wire Corporation: www.encorewire.com/#sle.

c. Southwire Company: www.southwire.com/#sle.

B. Conductor Stranding:

1. Feeders and Branch Circuits:

a. Size 10 AWG and Smaller: Solid.

b. Size 8 AWG and Larger: Stranded.

C. Insulation Voltage Rating: 600 V.

D. Insulation:

1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.

a. Installed Underground: Type XHHW-2.

2.4 METAL-CLAD CABLE

A. Manufacturers:

1. AFC Cable Systems Inc: www.afcweb.com/#sle.

2. Encore Wire Corporation: www.encorewire.com/#sle.

3. Southwire Company: www.southwire.com/#sle.

B. Description: NFPA 70, Type MC cable listed and labeled as complying with UL 1569, and listed for use in classified firestop systems to be used.

C. Conductor Stranding:

1. Size 10 AWG and Smaller: Solid.

2. Size 8 AWG and Larger: Stranded.

D. Insulation Voltage Rating: 600 V.

E. Insulation: Type THHN, THHN/THWN, or THHN/THWN-2.

F. Provide dedicated neutral conductor for each phase conductor where indicated or required.

G. Grounding: Full-size integral equipment grounding conductor.

H. Armor: Steel, interlocked tape.

I. Provide PVC jacket applied over cable armor where indicated or required for environment of installed location.

2.5 WIRING CONNECTORS

A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.

B. Connectors for Grounding and Bonding: Comply with Section 26 0526.

C. Wiring Connectors for Splices and Taps:

1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.

2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.

D. Wiring Connectors for Terminations:

1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.

2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.

3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.

4. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.

5. Aluminum Conductors: Use compression connectors for all connections.

E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.

F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.

G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.

H. Mechanical Connectors: Provide bolted type or set-screw type.

I. Compression Connectors: Provide circumferential type or hex type crimp configuration.

2.6 WIRING ACCESSORIES

A. Electrical Tape:

1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.

2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.

B. Oxide Inhibiting Compound: Listed; suitable for use with the conductors or cables to be installed.

C. Wire Pulling Lubricant: Listed; suitable for use with the conductors or cables to be installed and suitable for use at the installation temperature.

D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that interior of building has been protected from weather.

B. Verify that work likely to damage wire and cable has been completed.

C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.

D. Verify that raceway installation is complete and supported.

E. Verify that field measurements are as shown on the drawings.

F. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

B. Verify that interior of building has been protected from weather.

3.3 INSTALLATION

A. Circuiting Requirements:

1. Unless dimensioned, circuit routing indicated is diagrammatic.

2. When circuit destination is indicated without specific routing, determine exact routing required.

3. Arrange circuiting to minimize splices.

4. Include circuit lengths required to install connected devices within 10 ft of location indicated.

5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.

6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.

7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is permitted, under the following conditions:

a. Provide no more than six current-carrying conductors in a single raceway. Dedicated neutral conductors are considered current-carrying conductors.

8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.

B. Install products in accordance with manufacturer's instructions.

C. Install conductors and cable in a neat and workmanlike manner in accordance with NECA 1.

D. Installation in Raceway:

1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.

2. Pull all conductors and cables together into raceway at same time.

3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.

4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.

E. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.

F. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.

1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.

G. Terminate cables using suitable fittings.

1. Metal-Clad Cable (Type MC):

a. Use listed fittings.

b. Cut cable armor only using specialized tools to prevent damaging conductors or insulation. Do not use hacksaw or wire cutters to cut armor.

H. Install conductors with a minimum of 12 inches of slack at each outlet.

I. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.

J. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.

K. Make wiring connections using specified wiring connectors.

1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.

2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.

3. Do not remove conductor strands to facilitate insertion into connector.

4. Clean contact surfaces on conductors and connectors to suitable remove corrosion, oxides, and other contaminates. Do not use wire brush on plated connector surfaces.

5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

L. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.

M. Insulate ends of spare conductors using vinyl insulating electrical tape.

N. Color Code Legend: Provide identification label identifying color code for ungrounded conductors at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

O. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

P. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

END OF SECTION

SECTION 26 0526 - GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Grounding and bonding requirements.

B. Conductors for grounding and bonding.

C. Connectors for grounding and bonding.

D. Ground bars.

E. Grounding and bonding components.

F. Building Grounding System consisting of Riser conductors and Grounding Plates located in Electrical rooms and Data closets.

1.2 RELATED REQUIREMENTS

A. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.

B. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide for active electrodes and connections.

C. Project Record Documents: Record actual locations of components and grounding electrodes.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 GROUNDING AND BONDING REQUIREMENTS

A. Do not use products for applications other than as permitted by NFPA 70 and product listing.

B. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.

C. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

D. Bonding and Equipment Grounding:

1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.

2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.

3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.

4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.

6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.

7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:

a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.

b. Metal gas piping.

8. Provide bonding for metal building frame.

E. Isolated Ground System:

1. Where isolated ground receptacles or other isolated ground connections are indicated, provide separate isolated/insulated equipment grounding conductors.

2. Connect isolated/insulated equipment grounding conductors only to separate isolated/insulated equipment ground busses.

3. Connect the isolated/insulated equipment grounding conductors to the solidly bonded equipment ground bus only at the service disconnect or separately derived system disconnect. Do not make any other connections between isolated ground system and normal equipment ground system on the load side of this connection.

F. Communications Systems Grounding and Bonding:

1. Provide intersystem bonding termination at service equipment or metering equipment enclosure and at disconnecting means for any additional buildings or structures in accordance with NFPA 70.

2.2 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.

2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in addition to requirements of Section 26 0519:

1. Use insulated copper conductors unless otherwise indicated.

a. Exceptions:

1) Use bare copper conductors where installed underground in direct contact with earth.

2) Use bare copper conductors where directly encased in concrete (not in raceway).

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.

2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.

3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.

2. Size: As indicated.

3. Holes for Connections: As indicated or as required for connections to be made.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that work likely to damage grounding and bonding system components has been completed.

B. Verify that field measurements are as shown on the drawings.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify existing conditions prior to beginning work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Make grounding and bonding connections using specified connectors.

1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.

2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.

3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.

4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.

5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.

C. Identify grounding and bonding system components in accordance with Section 26 0553.

D. Bond all conduits and/or other conductor enclosures.

E. Provide 12 AWG copper wire in all surface metal raceway and in all multi-outlet assemblies. Attach to ground terminals of each wiring device and bond to the conduit grounding system.

F. Equipment Grounding Conductor: Provide separate, insulated conductor within each feeder and branch circuit raceway. Terminate each end on suitable lug, bus, or bushing.

1. Bond to all metal boxes that the conductors pass through, including, but not limited to, pull boxes, junction boxes, and outlet boxes. The means of connection shall be through a grounding screw or other listed grounding device that is used for no other purpose.

END OF SECTION

SECTION 26 0529 - HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Support and attachment components for equipment, conduit, cable, boxes, and other electrical work.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.3 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide manufacturer’s catalog data for fastening systems.

1.4 QUALITY ASSURANCE

A. Comply with NFPA 70.

B. Comply with applicable building code.

PART 2 PRODUCTS

2.1 SUPPORT AND ATTACHMENT COMPONENTS

A. General Requirements:

1. Comply with the following. Where requirements differ, comply with most stringent.

   a. NFPA 70.

   b. Requirements of authorities having jurisdiction.

2. Provide all required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for the complete installation of electrical work.

3. Provide products listed, classified, and labeled as suitable for the purpose intended, where applicable.

4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for the load to be supported with a minimum safety factor of _____. Include consideration for vibration, equipment operation, and shock loads where applicable.

5. Do not use products for applications other than as permitted by NFPA 70 and product listing.

6. Steel Components: Use corrosion resistant materials suitable for the environment where installed.

    a. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

    b. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.

B. Conduit and Cable Supports: Straps, clamps, etc. suitable for the conduit or cable to be supported.

1. Conduit Straps: One-hole or two-hole type; steel or malleable iron.

2. Conduit Clamps: Bolted type unless otherwise indicated.

C. Outlet Box Supports: Hangers, brackets, etc. suitable for the boxes to be supported.

D. Metal Channel (Strut) Framing Systems: Factory-fabricated continuous-slot metal channel (strut) and associated fittings, accessories, and hardware required for field-assembly of supports.

1. Comply with MFMA-4.

E. Hanger Rods: Threaded zinc-plated steel unless otherwise indicated.

F. Anchors and Fasteners:

1. Unless otherwise indicated and where not otherwise restricted, use the anchor and fastener types indicated for the specified applications.

2.2 MATERIALS

A. Hangers, Supports, Anchors, and Fasteners - General: Corrosion-resistant materials of size and type adequate to carry the loads of equipment and conduit, including weight of wire in conduit.

B. Supports: Fabricated of structural steel or formed steel members; galvanized or painted. All ferrous fasteners exposed to outside conditions and refrigerated spaces shall be coated with corrosion resistant, plated finish to prevent rust.

C. Anchors and Fasteners:

1. Concrete Structural Elements: Use precast inserts, expansion anchors, or preset inserts.

2. Steel Structural Elements: Use beam clamps, steel spring clips, or welded fasteners.

3. Concrete Surfaces: Use expansion anchors.

4. Hollow Masonry, Plaster, and Gypsum Board Partitions: Use toggle bolts.

5. Solid Masonry Walls: Use expansion anchors or preset inserts.

6. Sheet Metal: Use sheet metal screws.

7. Wood Elements: Use wood screws.

D. All ferrous fasteners exposed to outside conditions and refrigerated spaces shall be coated with corrosion resistant, plated finish to prevent rust.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install support and attachment components in a neat and workmanlike manner in accordance with NECA 1.

C. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

D. Unless specifically indicated or approved by the Design Professional, do not provide support from suspended ceiling support system or ceiling grid.

E. Unless specifically indicated or approved by the Design Professional, do not provide support from roof deck.

F. Do not penetrate or otherwise notch or cut structural members without approval of Structural Design Professional.

G. Equipment Support and Attachment:

1. Use metal fabricated supports or supports assembled from metal channel (strut) to support equipment as required.

2. Use metal channel (strut) secured to studs to support equipment surface-mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.

3. Use metal channel (strut) to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.

4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.

H. Secure fasteners according to manufacturer's recommended torque settings.

I. Remove temporary supports.

END OF SECTION

SECTION 26 0533.13 - CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Galvanized steel rigid metal conduit (RMC).

B. Intermediate metal conduit (IMC).

C. Liquidtight flexible metal conduit (LFMC).

D. Electrical metallic tubing (EMT).

E. Liquidtight flexible nonmetallic conduit (LFNC).

F. Conduit fittings.

G. Conduit, fittings and conduit bodies.

1.2 RELATED REQUIREMENTS

A. Section 07 8413 - Penetration Firestopping

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

1. Includes additional requirements for fittings for grounding and bonding.

C. Section 26 0529 - Hangers and Supports. .

D. Section 26 0535 - Surface Raceways.

E. Section 26 0553 - Identification for Electrical Systems.

F. Section 26 0533.16 - Boxes for Electrical Systems.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate minimum sizes of conduits with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.

2. Coordinate the arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts installed under other sections or by others.

3. Verify exact conduit termination locations required for boxes, enclosures, and equipment installed under other sections or by others.

4. Coordinate the work with other trades to provide roof penetrations that preserve the integrity of the roofing system and do not void the roof warranty.

5. Notify Design Professional of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Do not begin installation of conductors and cables until installation of conduit is complete between outlet, junction and splicing points.

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Product Data: Provide for metallic conduit, liquidtight flexible metal conduit, nonmetallic conduit, and fittings.

C. Project Record Documents: Accurately record actual routing of conduits larger than 2 inches.

1.6 ABBREVIATIONS

A. GRS indicates galvanized rigid steel conduit also termed rigid steel conduit .

B. RGS indicates galvanized rigid steel conduit also termed rigid steel conduit .

C. GRC indicates galvanized rigid steel conduit also termed rigid steel conduit .

D. IMC indicates intermediate metal conduit whether made of galvanized steel or aluminum. See Part 2 for specification.

E. EMT indicates Electrical Metallic Tubing whether made of galvanized steel or aluminum. See Part 2 for specification.

1.7 DELIVERY, STORAGE, AND HANDLING

A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

B. Accept conduit on site. Inspect for damage.

C. Protect conduit from corrosion and entrance of debris by storing above grade. Provide appropriate covering.

D. Protect PVC conduit from sunlight.

PART 2 PRODUCTS

2.1 CONDUIT APPLICATIONS

A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70 and product listing.

B. Unless otherwise indicated and where not otherwise restricted, use the conduit types indicated for the specified applications. Where more than one listed application applies, comply with the most restrictive requirements. Where conduit type for a particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use rigid PVC conduit.

2. Exterior, Direct-Buried (lighting circuits): Use rigid PVC conduit.

3. Exterior, Embedded Within Concrete (electrical service entrance): Use rigid PVC conduit.

4. Where rigid polyvinyl (PVC) conduit is provided, transition to galvanized steel rigid metal conduit where emerging from underground.

5. Where steel conduit emerges from concrete into soil, use corrosion protection tape to provide supplementary corrosion protection for a minimum of 4 inches on either side of where conduit emerges or use PVC-coated galvanized steel rigid metal conduit.

D. Concealed Within Masonry Walls: Use electrical metallic tubing (EMT).

E. Concealed Within Hollow Stud Walls: Use electrical metallic tubing (EMT).

F. Concealed Above Accessible Ceilings: Use electrical metallic tubing (EMT).

G. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

H. Exposed, Interior, Not Subject to Physical Damage: Use electrical metallic tubing (EMT).

I. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

1. Locations subject to physical damage include, but are not limited to:

a. Where exposed below 8 feet, except within electrical and communication rooms or closets.

J. Exposed, Exterior: Use galvanized steel rigid metal conduit, intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit.

K. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit or intermediate metal conduit (IMC).

L. Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit.

1. Maximum Length: 6 feet.

M. Connections to Vibrating Equipment:

1. Dry Locations: Use flexible metal conduit.

2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.

3. Maximum Length: 6 feet unless otherwise indicated.

4. Vibrating equipment includes, but is not limited to:

a. Transformers.

b. Motors.

2.2 CONDUIT REQUIREMENTS

A. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling a mandrel through them.

B. Provide all conduit, fittings, supports, and accessories required for a complete raceway system.

C. Provide products listed, classified, and labeled as suitable for the purpose intended.

D. Minimum Conduit Size, Unless Otherwise Indicated:

1. Branch Circuits: 1/2 inch (16 mm) trade size.

2. Underground, Interior: 3/4 inch (21 mm) trade size.

3. Underground, Exterior: 1 inch (27 mm) trade size.

E. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.3 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com/#sle.

2. Republic Conduit: www.republic-conduit.com/#sle.

3. Wheatland Tube Company: www.wheatland.com/#sle.

B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.

C. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.4 INTERMEDIATE METAL CONDUIT (IMC)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com/#sle.

2. Republic Conduit: www.republic-conduit.com/#sle.

3. Wheatland Tube Company: www.wheatland.com/#sle.

B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

C. Fittings:

1. Non-Hazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use threaded type fittings only. Threadless set screw and compression (gland) type fittings are not permitted.

2.5 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

A. Manufacturers:

1. AFC Cable Systems, Inc: www.afcweb.com.

2. Electri-Flex Company: www.electriflex.com.

3. International Metal Hose: www.metalhose.com.

B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

2.6 ELECTRICAL METALLIC TUBING (EMT)

A. Manufacturers:

1. Allied Tube & Conduit: www.alliedeg.com/#sle.

2. Republic Conduit: www.republic-conduit.com/#sle.

3. Beck Manufacturing, Inc: www.beckmfg.com.

4. Wheatland Tube Company: www.wheatland.com.

B. Description: NFPA 70, Type EMT steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.

C. Fittings:

1. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.

2. Material: Use steel or malleable iron.

3. Connectors and Couplings: Use set-screw type.

a. Do not use indenter type connectors and couplings.

2.7 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

A. Manufacturers:

1. Cantex Inc: www.cantexinc.com/#sle.

2. Carlon, a brand of Thomas & Betts Corporation: www.carlon.com/#sle.

3. JM Eagle: www.jmeagle.com/#sle.

B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

C. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.8 LIQUIDTIGHT FLEXIBLE NONMETALLIC CONDUIT (LFNC)

A. Description: NFPA 70, Type LFNC liquidtight flexible nonmetallic conduit listed and labeled as complying with UL 1660.

B. Fittings:

1. Manufacturer: Same as manufacturer of conduit to be connected.

2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B; suitable for the type of conduit to be connected.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive conduits.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify routing and termination locations of conduit prior to rough-in.

E. Conduit routing is shown on drawings in approximate locations unless dimensioned. Route as required to complete wiring system.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install conduit in a neat and workmanlike manner in accordance with NECA 1.

C. Install galvanized steel rigid metal conduit (RMC) in accordance with NECA 101.

D. Install intermediate metal conduit (IMC) in accordance with NECA 101.

E. Install PVC-coated galvanized steel rigid metal conduit (RMC) using only tools approved by the manufacturer.

F. Install rigid polyvinyl chloride (PVC) conduit in accordance with NECA 111.

G. Install liquidtight flexible nonmetallic conduit (LFNC) in accordance with NECA 111.

H. Conduit Routing:

1. Unless dimensioned, conduit routing indicated is diagrammatic.

2. When conduit destination is indicated without specific routing, determine exact routing required.

3. Conceal all conduits unless specifically indicated to be exposed.

4. Conduits in the following areas may be exposed, unless otherwise indicated:

    a. Electrical rooms.

    b. Mechanical equipment rooms.

    c. Within joists in areas with no ceiling.

5. Unless otherwise approved, do not route conduits exposed:

    a. Across floors.

    b. Across roofs.

    c. Across top of parapet walls.

    d. Across building exterior surfaces.

6. Conduits installed underground or embedded in concrete may be routed in the shortest possible manner unless otherwise indicated. Route all other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.

7. Arrange conduit to maintain adequate headroom, clearances, and access.

8. Arrange conduit to provide no more than the equivalent of four 90 degree bends between pull points.

9. Arrange conduit to provide no more than 150 feet between pull points.

10. Route conduits above water and drain piping where possible.

11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.

12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.

13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:

    a. Heaters.

    b. Hot water piping.

I. Conduit Support:

1. Secure and support conduits in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods.

2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.

3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.

4. Use conduit strap to support single surface-mounted conduit.

    a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.

5. Use metal channel (strut) with accessory conduit clamps to support multiple parallel surface-mounted conduits.

6. Use conduit clamp to support single conduit from beam clamp or threaded rod.

7. Use trapeze hangers assembled from threaded rods and metal channel (strut) with accessory conduit clamps to support multiple parallel suspended conduits.

8. Use non-penetrating rooftop supports to support conduits routed across rooftops (only where approved).

J. Connections and Terminations:

1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.

2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.

3. Use suitable adapters where required to transition from one type of conduit to another.

4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.

5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.

6. Where spare conduits stub up through concrete floors and are not terminated in a box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.

7. Provide insulating bushings or insulated throats at all conduit terminations to protect conductors.

8. Secure joints and connections to provide maximum mechanical strength and electrical continuity.

K. Penetrations:

1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Design Professional.

2. Make penetrations perpendicular to surfaces unless otherwise indicated.

3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.

4. Conceal bends for conduit risers emerging above ground.

5. Seal interior of conduits entering the building from underground at first accessible point to prevent entry of moisture and gases.

6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.

7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty. Include proposed locations of penetrations and methods for sealing with submittals.

8. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

L. Underground Installation:

1. Minimum Cover, Unless Otherwise Indicated or Required:

a. Underground, Exterior: 24 inches.

2. Provide underground warning tape in accordance with Section 26 0553 along entire conduit length for service entrance where not concrete-encased.

M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):

1. Maximum Conduit Size: 1 inch (27 mm) unless otherwise approved.

2. Secure conduits to prevent floating or movement during pouring of concrete.

N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide concrete in accordance with Section 03 3000 with minimum concrete cover of 3 inches on all sides unless otherwise indicated.

O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:

1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where conduits are subject to earth movement by settlement or frost.

P. Conduit Sealing:

1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:

a. Where conduits enter building from outside.

b. Where service conduits enter building from underground distribution system.

c. Where conduits enter building from underground.

d. Where conduits may transport moisture to contact live parts.

2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:

a. Where conduits pass from outdoors into conditioned interior spaces.

b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

Q. Condensation Prevention: Where conduits cross barriers between areas of potential substantial temperature differential, provide sealing fitting or approved sealing compound at an accessible point near the penetration to prevent condensation. This includes, but is not limited to:

1. Where conduits pass from outdoors into conditioned interior spaces.

2. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.

R. Provide pull string in all empty conduits and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.

S. Provide grounding and bonding in accordance with Section 26 0526.

3.3 CLEANING

A. Clean interior of conduits to remove moisture and foreign matter.

3.4 PROTECTION

A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 0533.16 - BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.

B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

C. Wall and ceiling outlet boxes.

D. Floor boxes.

E. Pull and junction boxes.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 0533.13 - Conduit for Electrical Systems:

1. Conduit bodies and other fittings.

2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.

D. Section 26 2726 - Wiring Devices:

1. Wall plates.

2. Additional requirements for locating boxes for wiring devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code; 2023 Edition.

1.4 DESIGN INTENT

A. Careful coordination is required with backbox placement. In general, unless noted otherwise outlets and switches shall be placed as described on the drawings.

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.

4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.

5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.

6. Coordinate the work with other trades to preserve insulation integrity.

7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.

8. Notify the Design Professional of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 26 0510.

B. Provide cut sheets on floor outlet boxes only.

1.6 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70, National Electrical Code; 2023 Edition.

PART 2 PRODUCTS

2.1 BOXES

A. General Requirements:

1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.

2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.

3. Provide products listed, classified, and labeled as suitable for the purpose intended.

4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

5. Provide grounding terminals within boxes where equipment grounding conductors terminate.

B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:

1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.

2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.

3. Use suitable concrete type boxes where flush-mounted in concrete.

4. Use suitable masonry type boxes where flush-mounted in masonry walls.

5. Use raised covers suitable for the type of wall construction and device configuration where required.

6. Use shallow boxes where required by the type of wall construction.

7. Do not use "through-wall" boxes designed for access from both sides of wall.

8. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.

9. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.

10. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.

11. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes.

12. Wall Plates: Comply with Section 26 2726.

C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:

1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.

2. NEMA 250 Environment Type, Unless Otherwise Indicated:

3. Junction and Pull Boxes Larger Than 100 cubic inches:

a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.

2.2 OUTLET BOXES

A. Sheet Metal Outlet Boxes: NEMA OS 1, galvanized steel.

1. Luminaire and Equipment Supporting Boxes: Rated for weight of equipment supported; include 3/8 inch male fixture studs where required.

a. Boxes and covers shall not be less than 1/16 inch thick.

b. Box shall be anchored in place.

c. Unless otherwise specified, ceiling outlet boxes need not be provided with plaster rings and shall be minimum two inches (2") deep. Boxes shall be provided with blank covers.

2. Concrete Ceiling Boxes: Concrete type.

3. Switch and wall receptacles outlet boxes in plaster walls shall be four inches (4") square.

4. In exposed masonry or tile walls, four inch (4") square boxes with deep plaster covers shall be used.

B. Cast Boxes: NEMA FB 1, Type FD, cast feralloy. Provide gasketed cover by box manufacturer. Provide threaded hubs.

C. Wall Plates for Finished Areas: As specified in Section 26 2726.

2.3 FLOOR BOXES

A. Provide as shown, complete with service fittings or unactivated as indicated.

B. Floor boxes shall comply with NEMA OS 1.

C. Trim rings around floorboxes of any type must be less than 1/4". Greater than this height will require re-working by the contractor at no cost to the Owner or Design Professional.

D. All boxes in ground floor shall be watertight with threaded hubs. Boxes on other floors shall be concrete tight. All connections shall be made to prevent entrance of moisture. Where outlets are shown adjacent, two or three-gang boxes shall be used. Provide voltage barrier between power and communication sections.

E. Service Fittings: As specified in Section 26 2726.

F. Manufacturers:

1. Hubbell

2. Steel City

3. RFB

2.4 PULL AND JUNCTION BOXES

A. All pullboxes and junction boxes shall be sized in accordance with the National Electrical Code.

B. Sheet Metal Boxes: NEMA OS 1, galvanized steel.

C. Hinged Enclosures: As specified in Section 26 2716.

D. Surface Mounted Exposed Boxes: Boxes shall be corrosion resistant cast iron in wet locations. Use solid steel boxes with no knockouts in dry locations. Holes for raceways shall be drilled on the job.

E. Surface Mounted Cast Metal Box: NEMA 250, Type 4; flat-flanged, surface mounted junction box:

1. Material: Galvanized cast iron.

2. Cover: Furnish with ground flange, neoprene gasket, and galvanized steel cover/screws.

F. In-Ground Cast Metal Box: NEMA 250, Type 6, outside flanged, recessed cover box for flush mounting:

1. Material: Galvanized cast iron.

2. Cover: Nonskid cover with neoprene gasket and stainless steel cover screws.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on drawings.

B. Verify that mounting surfaces are ready to receive boxes.

C. Verify that conditions are satisfactory for installation prior to starting work.

D. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in.

E. Verify locations of floor boxes and outlets in offices and work areas prior to rough-in. In General, Data outlets for anything other than wireless access points or cameras should always have receptacles adjacent. If not shown this way, notify the architect prior to any rough in. A receptacle should always be adjacent to a data/catv outlet.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Perform work in a neat and workmanlike manner in accordance with NECA 1 and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide separate boxes for emergency power and normal power systems.

E. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.

F. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.

G. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.

H. Box Locations:

1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 3100 as required where approved by the Architect.

2. Unless dimensioned, box locations indicated are approximate.

3. Locate boxes as required for devices installed under other sections or by others.

a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 2726.

b. Communications Systems Outlets: Comply with Section 27 1000.

4. Locate boxes so that wall plates do not span different building finishes.

5. Locate boxes so that wall plates do not cross masonry joints.

6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.

7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.

8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.

9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.

a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.

b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.

10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 0533.13.

11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:

a. Concealed above accessible suspended ceilings.

b. Within joists in areas with no ceiling.

c. Electrical rooms.

d. Mechanical equipment rooms.

I. Box Supports:

1. Secure and support boxes in accordance with NFPA 70 and Section 26 0529 using suitable supports and methods.

2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.

J. Install boxes plumb and level.

K. Flush-Mounted Boxes:

1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.

2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.

3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.

L. Install boxes as required to preserve insulation integrity.

M. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

N. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 8400.

O. Close unused box openings.

P. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.

Q. Provide grounding and bonding in accordance with Section 26 0526.

R. Install boxes securely, in a neat and workmanlike manner, as specified in NECA 1.

S. Provide outlet boxes for lighting fixtures, wall switches, wall receptacles, telecommunications equipment, protection equipment, antenna, and all equipment.

T. Coordinate installation of outlet boxes for equipment connected under Section 26 2717.

U. Unless otherwise indicated wall outlet boxes shall be placed with center lines at distances above the finished floor (except at casework) as labeled on the drawings.

V. The approximate locations of outlets are shown on the plans. The exact locations shall be determined at the building. The right is reserved to change the exact location of any outlet a maximum of 10 feet before it is permanently installed without additional cost.

W. Orient boxes to accommodate wiring devices oriented as specified in Section 26 2726.

X. Maintain headroom and present neat mechanical appearance.

Y. Install pull boxes and junction boxes above accessible ceilings and in unfinished areas only.

Z. Inaccessible Ceiling Areas: Install outlet and junction boxes no more than 6 inches from ceiling access panel or from removable recessed luminaire.

AA. Install boxes to preserve fire resistance rating of partitions and other elements, using materials and methods specified.

BB. Coordinate mounting heights and locations of outlets mounted above counters, benches, and backsplashes.

CC. Locate outlet boxes to allow luminaires positioned as shown on reflected ceiling plan.

DD. Where outlets are shown above cabinets and casework, the outlets shall be mounted so the bottom of the device plates will be 1 to 3 inches above the backsplash.

1. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line. Outlets shown back to back on a common wall shall be offset a minimum of 10 inches to dampen sound transmission through the wall. On all walls with 1 hour or greater fire rating, "back to back" outlets shall be minimum 24 inches apart with a stud between outlets for gypboard constructed partition.

2. Where the mounting height of an outlet is not shown on the plans or specifications, the contractor shall contact the architect for exact mounting height requirements.

3. At locations where two or more devices are shown adjacent and at the same mounting height, they shall be installed in one outlet box and covered with one face plate.

EE. Where outlets are installed in unfinished block or tile partitions, they shall be installed at the points in the tile to permit the face plate to cover the rough opening. The horizontal and vertical locations indicated may be altered to permit doing this. However, contractor shall check the Architectural drawings to prevent conflicts when shifting location. Where outlets are shown back to back on a common wall, they shall be offset 10" to avoid sound transmission.

FF. Outlets in Poured-in-Place Concrete: A six by six by three inch (6"X6"X3") deep wood box shall be placed in the form before the concrete is poured. This box shall be removed before

waterproofing is applied. Install outlet and grout around the box. Boxes shall be set so that cover plates are flush.

GG. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.

HH. Use flush mounting outlet box in finished areas.

II. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches separation. Provide minimum 24 inches separation in acoustic rated walls.

JJ. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness.

KK. Use stamped steel bridges to fasten flush mounting outlet box between studs.

LL. Install flush mounting box without damaging wall insulation or reducing its effectiveness.

MM. Use adjustable steel channel fasteners for hung ceiling outlet box.

NN. Do not fasten boxes to ceiling support wires.

OO. Support boxes independently of conduit. Provide threaded rods, screws, bolts, toggle bolts, etc. for support. Do not use clips or other hardware to attach boxes to ceiling grids.

PP. Use gang box where more than one device is mounted together. Do not use sectional box.

QQ. Use two gang box with plaster ring for single device outlets.

RR. Floor boxes shall be set an readjusted to provide a smooth surface, conforming to elevation and slope of the surrounding finished floor. In carpeted areas, flanges shall be installed to protect carpet edges. Provide tapped holes in all boxes as determined by conduit entering box.

SS. A carpet flange shall be installed on floor boxes in all carpeted areas. In non-carpeted areas, a beveled carpet flange shall be installed with the entire perimeter in contact with the floor finishing material, and caulking compound shall be provided beneath the flange to keep water from seeping under the flange.

TT. Set floor boxes level.

UU. Boxes for any specialty devices such as speakers, fire alarm horns and stations, and program signals shall be obtained from the equipment manufacturer.

VV. Trim rings around floorboxes of any type must be less than 1/4". Greater than this height will require re-working by the contractor at no cost to the Owner or Design Professional.

3.3 ADJUSTING

A. Adjust floor boxes flush with finish flooring material. Minimize floorbox height to reduce tripping hazard. Tile and carpet must be cut in order for the box edge to come in contact with the floor substrate - the box shall not rest on the tile or carpet.

B. Adjust flush-mounting outlets to make front flush with finished wall material.

C. Install knockout closures in unused box openings.

3.4 CLEANING

A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

END OF SECTION

SECTION 26 0553 - IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical identification requirements.

B. Identification nameplates and labels.

C. Voltage markers.

D. Underground warning tape.

E. Warning signs and labels.

1.2 RELATED REQUIREMENTS

A. Section 09 9000 - Painting and Coating.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.

C. Section 26 0573 - Protective Device Coordination Study: Arc flash hazard warning labels.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

PART 2 PRODUCTS

2.1 IDENTIFICATION REQUIREMENTS

A. Identification for Equipment:

1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.

a. Panelboards:

1) Identify ampere rating.

2) Identify voltage and phase.

3) Identify power source and circuit number. Include location when not within sight of equipment.

4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.

5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.

6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Identify spares and spaces.

b. Enclosed switches, circuit breakers, and motor controllers:

1) Identify voltage and phase.

2) Identify power source and circuit number. Include location when not within sight of equipment.

3) Identify load(s) served. Include location when not within sight of equipment.

2. Emergency System Equipment:

a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.

b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.

3. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70 including but not limited to the following.

a. Service equipment.

b. Industrial control panels.

c. Motor control centers.

d. Elevator control panels.

e. Industrial machinery.

4. Arc Flash Hazard Warning Labels: Comply with Section 26 0573.

B. Identification for Conductors and Cables:

1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 0519.

2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.

C. Identification for Raceways:

1. Use voltage markers or color-coded bands to identify systems other than normal power system for accessible conduits at maximum intervals of 20 feet.

    a. Color-Coded Bands: Use field-painting or vinyl color coding electrical tape to mark bands 3 inches wide.

        1) Color Code:

            (a) Emergency Power System: Yellow .

            (b) Fire Alarm System: Red.

        2) Field-Painting: Comply with Section 09 9000.

        3) Vinyl Color Coding Electrical Tape: Comply with Section 26 0519.

        4) Hand-write on the end of spare conduit the location of the terminating end if not within sight.

D. Identification for Boxes:

1. Use voltage markers or color coded boxes to identify systems other than normal power system.

    a. Color-Coded Boxes: Field-painted in accordance with Section 09 9000 per the same color code used for raceways.

        1) Emergency Power System: Yellow .

2. Use identification labels or handwritten text using indelible marker to identify circuits enclosed.

E. Identification for Devices:

1. Use identification label or engraved wallplate to identify serving branch circuit for all receptacles.

2. Use identification label or engraved wallplate to identify load controlled by the light switch.

2.2 IDENTIFICATION NAMEPLATES AND LABELS

A. Identification Nameplates:

1. Materials:

    a. Indoor Clean, Dry Locations: Use plastic nameplates.

    b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.

2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.

    a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.

3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.

4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.

5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.

B. Identification Labels:

1. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.

2. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.

C. Format for Equipment Identification:

1. Minimum Size: 1 inch by 2.5 inches.

2. Legend:

    a. Equipment designation or other approved description.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height:

    a. System Designation: 1 inch.

    b. Equipment Designation: 1/2 inch.

    c. Other Information: 1/4 inch.

5. Color:

    a. Normal Power System: White text on black background.

D. Format for Receptacle Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Power source and circuit number or other designation indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Black text on clear background. RED on Clear for Emergency.

E. Format for Light Switch Identification:

1. Minimum Size: 3/8 inch by 1.5 inches.

2. Legend: Load controlled or other designation indicated.

3. Text: All capitalized unless otherwise indicated.

4. Minimum Text Height: 3/16 inch.

5. Color: Black text on clear background. RED on Clear for Emergency.

2.3 VOLTAGE MARKERS

A. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.

B. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.

C. Minimum Size:

1. Markers for Conduits: As recommended by manufacturer for conduit size to be identified.

2. Markers for Pull Boxes: 1 1/8 by 4 1/2 inches.

3. Markers for Junction Boxes: 1/2 by 2 1/4 inches.

D. Legend:

1. Markers for System Identification:

a. Emergency Power System: Text "EMERGENCY".

E. Color: Black text on orange background unless otherwise indicated.

2.4 UNDERGROUND WARNING TAPE

A. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.

B. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.

C. Legend: Type of service, continuously repeated over full length of tape.

D. Color:

2.5 WARNING SIGNS AND LABELS

A. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.

B. Warning Signs:

1. Materials:

2. Minimum Size: 7 by 10 inches unless otherwise indicated.

C. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.

2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.

3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.1 PREPARATION

A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:

1. Surface-Mounted Equipment: Enclosure front.

2. Flush-Mounted Equipment: Inside of equipment door.

3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.

4. Elevated Equipment: Legible from the floor or working platform.

5. Branch Devices: Adjacent to device.

6. Interior Components: Legible from the point of access.

7. Conduits: Legible from the floor.

8. Boxes: Outside face of cover.

9. Conductors and Cables: Legible from the point of access.

10. Devices: Outside face of cover.

C. Install identification products centered, level, and parallel with lines of item being identified.

D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.

E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.

F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.

G. Mark all handwritten text, where permitted, to be neat and legible.

END OF SECTION

SECTION 26 0573 - PROTECTIVE DEVICE COORDINATION STUDY

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Short-circuit study.

B. Protective device coordination study.

C. Arc flash and shock risk assessment.

1. Includes arc flash hazard warning labels.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

2. Notify the Design Professional of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

B. Sequencing:

1. Submit study reports prior to or concurrent with product submittals.

2. Do not order equipment until matching study reports and product submittals have both been evaluated by the Design Professional.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements for submittal procedures.

B. Study preparer's qualifications.

C. Study reports, stamped or sealed and signed by study preparer.

D. Study Report: Submit short circuit and protective device studies as specified, prior to submission of product data submittals or ordering or fabrication of protective devices.

1. Evaluation of product data submittals by the Design Professional will not commence until acceptable studies have been submitted.

2. Include stamp or seal and signature of preparing engineer.

E. Field Engineer Qualifications.

F. Field Inspection Report: Show final adjusted settings of protective devices.

G. Certificates: Prior to Material Completion, certify that field adjustable protective devices have been set in accordance with requirements of protective device analysis.

H. Project Record Documents: Revise protective device study as required to show as-built conditions.

1. Submit not less than 60 days prior to final inspection of electrical system.

2. Include hard copies with operation and maintenance data submittals.

3. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.5 POWER SYSTEM STUDIES

A. Scope of Studies:

1. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).

2. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.

B. General Study Requirements:

1. Comply with NFPA 70, National Electrical Code; 2023 Edition.

2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.

C. Data Collection:

1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.

a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.

1) Obtain up-to-date information from Utility Company.

b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.

c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.

d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.

e. Protective Devices:

1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).

2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).

f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.

g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.

D. Short-Circuit Study:

1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.

2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:

a. Maximum utility fault currents.

b. Maximum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.

E. Protective Device Coordination Study:

1. Comply with applicable portions of IEEE 242 and IEEE 399.

2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

3. Analyze protective devices and associated settings for suitable margins between time-current curves to achieve full selective coordination while providing adequate protection for equipment and conductors.

F. Arc Flash and Shock Risk Assessment:

1. Comply with NFPA 70E.

2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

3. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:

a. Maximum and minimum utility fault currents.

b. Maximum and minimum motor contribution.

c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).

G. Study Reports:

1. General Requirements:

a. Identify date of study and study preparer.

b. Identify study methodology and software product(s) used.

c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.

d. Identify base used for per unit values.

e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.

f. Include conclusions and recommendations.

2. Short-Circuit Study:

a. For each scenario, identify at each bus location:

1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).

2) Fault point X/R ratio.

3) Associated equipment short circuit current ratings.

b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.

3. Protective Device Coordination Study:

a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.

b. For each graph include (where applicable):

1) Partial single-line diagram identifying the portion of the system illustrated.

2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.

3) Conductors: Damage curves.

4) Transformers: Inrush points and damage curves.

5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.

6) Motors: Full load current, starting curves, and damage curves.

7) Capacitors: Full load current and damage curves.

c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.

1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.

2) Include ground fault pickup and delay.

3) Include fuse ratings.

4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.

d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:

a. For each scenario, identify at each bus location:

1) Calculated incident energy and associated working distance.

2) Calculated arc flash boundary.

3) Bolted fault current.

4) Arcing fault current.

5) Clearing time.

6) Arc gap distance.

b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.

c. Identify locations where the calculated maximum incident energy exceeds 40 calories per sq cm.

1.6 QUALITY ASSURANCE

A. Study Preparer Qualifications: Professional electrical engineer licensed in and with minimum five years' experience in the preparation of studies of similar type and complexity using specified computer software.

B. Study Preparer Qualifications: Electrical testing agency regularly engaged in short circuit and coordination studies, with at least 5 years' experience in work of this type, and employing professional electrical engineer licensed in to perform the studies.

C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.

D. The Contractor's Responsibility: Provide all project-related data needed by study preparer, including equipment, wire sizes, insulation types, conduit types, and actual circuit lengths.

PART 2 PRODUCTS

2.1 ARC FLASH HAZARD WARNING LABELS

A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.

1. Materials: Comply with Section 26 0553.

2. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.

a. Include orange header that reads "WARNING" where calculated incident energy is less than 40 calories per square cm.

b. Include red header that reads "DANGER" where calculated incident energy is 40 calories per square cm or greater.

c. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.

d. Include the following information:

1) Arc flash boundary.

2) Available incident energy and corresponding working distance.

3) Site-specific PPE (personnel protective equipment) requirements.

4) Nominal system voltage.

5) Limited approach boundary.

6) Restricted approach boundary.

7) Equipment identification.

8) Study preparer, report reference, and date calculations were performed.

2.2 PROTECTIVE DEVICES

A. Provide protective devices of ratings and settings as required so that the protective device closest to the fault will open first.

B. In addition to requirements specified elsewhere, provide overcurrent protective devices having ratings and settings in accordance with results of this analysis.

PART 3 EXECUTION

3.1 INSTALLATION

3.2 INSTALLATION

A. The contractor shall provide a permanent label on the Service Entrance Equipment indicating the available fault current rating at that location per the requirements of the National Electrical Code.

B. Install all labels from the Arc Flash Hazard Analysis at each piece of electrical equipment.

3.3 FIELD QUALITY CONTROL

A. Adjust equipment and protective devices for compliance with studies and recommended settings.

B. Notify the Design Professional of any conflicts with or deviations from studies. Obtain direction before proceeding.

C. Provide the services of a qualified field engineer and necessary tools and equipment to test, calibrate, and adjust the installed protective devices to conform to requirements determined by the coordination analysis.

D. Adjust installed protective devices having adjustable settings to conform to requirements determined by the coordination analysis.

E. Submit report showing final adjusted settings of all protective devices.

END OF SECTION

SECTION 26 0583 - WIRING CONNECTIONS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Electrical connections to equipment.

1.2 RELATED REQUIREMENTS

A. Section 26 0533.13 - Conduit for Electrical Systems.

B. Section 26 0519 - Low-Voltage Electrical Power Conductors and Cables (600 V and Less).

C. Section 26 0533.16 - Boxes for Electrical Systems.

D. Section 26 2726 - Wiring Devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition; National Fire Protection Association.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 COORDINATION

A. Obtain and review shop drawings, product data, manufacturer's wiring diagrams, and manufacturer's instructions for equipment furnished under other sections.

B. Determine connection locations and requirements.

C. Sequence rough-in of electrical connections to coordinate with installation of equipment.

D. General: No roughing shall be done until roughing drawings and exact electrical demand of equipment is obtained. Notify Design Professional of any discrepancies.

1. Mechanical:

a. Review tabulated sheet of Power Wiring Requirements of all Mechanical Equipment specified in Division 23 of Specifications. Conduit, conductor, and breaker sizes shown for mechanical equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical circuits compatible with the proposed mechanical equipment where the mechanical equipment conforms to Division 23 of the specifications, but does not conform to the electrical criteria of these contract documents . The Contractor shall submit the

proposed electrical modifications to the Design Professional for review prior to roughing. No additional costs to the contract will be allowed for these modifications.

b. Provide 4" thick concrete housekeeping pad beneath any equipment free standing on concrete floor. Pad shall extend 2" on all sides of equipment and shall be beveled 1 inch on all sides.

c. Provide conduit, wiring, boxes, adaptors for equipment terminations and disconnect switches. Provide power wiring through primary control device.

d. Starters, push-button stations, contactors, relays, limit and safety devices, and control items are specified in DIVISION 23 except as shown in Motor Control Center. Unless otherwise noted, all starters shall be mounted between 24" and 80" above finished floor. Push-button stations shall be mounted at switch height except as noted.

e. Kitchen Equipment Review tabulated sheet of Power Wiring Requirements of all kitchen equipment. Conduit, conductor, and breaker sizes shown for the equipment are based upon the best available information on the equipment specified. The Contractor shall be allowed to provide electrical branch circuits compatible with the kitchenequipment acceptable to the Architect, but not conforming to the electrical criteria of these contract documents . The Contractor shall submit the proposed electrical modifications to the Architect for review prior to roughing. No additional costs to the contract will be allowed for these changes.

f. Owner Furnished Equipment: Provide conduit, wiring, boxes, adaptors for equipment terminations, and disconnect switches. Make all connections indicated.

E. Sequence electrical connections to coordinate with start-up of equipment.

F. The intent is to provide SO cord connection, through a plug and receptacle provided by the contractor, to any kitchen equipment listed as "direct connect" on the kitchen equipment schedule. This will serve as the disconnecting means in most cases, without the need of additional, separate box-type disconnects. Pay close attention to the FLA ratings of kitchen devices and provide cord, plug, and receptacle rated for that current.

PART 2 PRODUCTS

2.1 MATERIALS

A. Cords and Caps: NEMA WD 6; match receptacle configuration at outlet provided for equipment.

1. Colors: Conform to NEMA WD 1.

2. Cord Construction: NFPA 70, Type SO, multiconductor flexible cord with identified equipment grounding conductor, suitable for use in damp locations.

3. Size: Suitable for connected load of equipment, length of cord, and rating of branch circuit overcurrent protection.

B. Wiring Devices: As specified in Section 26 2726.

C. Flexible Conduit: As specified in Section 26 0534.

D. Wire and Cable: As specified in Section 26 0519.

E. Boxes: As specified in Section 26 0537.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that equipment is ready for electrical connection, wiring, and energization.

3.2 ELECTRICAL CONNECTIONS

A. Make electrical connections in accordance with equipment manufacturer's instructions.

B. Make conduit connections to equipment using flexible conduit. Use liquidtight flexible conduit with watertight connectors in damp or wet locations.

C. Connect heat producing equipment using wire and cable with insulation suitable for temperatures encountered.

D. Provide receptacle outlet to accommodate connection with attachment plug.

E. Provide cord and cap where field-supplied attachment plug is required.

F. Install suitable strain-relief clamps and fittings for cord connections at outlet boxes and equipment connection boxes.

G. Install disconnect switches, controllers, control stations, and control devices to complete equipment wiring requirements.

H. Install terminal block jumpers to complete equipment wiring requirements.

I. Install interconnecting conduit and wiring between devices and equipment to complete equipment wiring requirements. Pay close attention to the requirements of DCU's and DAC's. The electrical contractor is responsible for interconnecting the wiring between these two pieces.

END OF SECTION

SECTION 26 2416 - PANELBOARDS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Power distribution panelboards.

B. Lighting and appliance panelboards.

C. Overcurrent protective devices for panelboards.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0526 - Grounding and Bonding for Electrical Systems.

C. Section 26 0529 - Hangers and Supports for Electrical Systems.

D. Section 26 0553 - Identification for Electrical Systems: Identification products and requirements.

E. Section 26 0573 - Protective Device Coordination Study: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

F. Section 26 2417- Surge Protective Devices.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.4 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.

2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.

3. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted panelboards where indicated.

4. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.

5. Notify the Design Professional of any conflicts with or deviations from the contract documents. Obtain direction before proceeding with work.

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for panelboards, enclosures, overcurrent protective devices, and other installed components and accessories.

C. Shop Drawings: Indicate outline and support point dimensions, voltage, main bus ampacity, integrated short circuit ampere rating, circuit breaker arrangement and sizes.

1. Include dimensioned plan and elevation views of panelboards and adjacent equipment with all required clearances indicated.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Project Record Documents: Record actual installed locations of panelboards and actual installed circuiting arrangements.

F. Maintenance Data: Include spare parts listing; source and current prices of replacement parts and supplies; and recommended maintenance procedures and intervals.

1.6 DELIVERY, STORAGE, AND HANDLING

A. Store in a clean, dry space. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.

B. Handle carefully in accordance with manufacturer's written instructions to avoid damage to panelboard internal components, enclosure, and finish.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Schneider Electric; Square D (basis of design).

B. ABB/GE.

C. Eaton.

D. Siemens.

2.2 PANELBOARDS - GENERAL REQUIREMENTS

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Short Circuit Current Rating:

1. Provide panelboards with listed short circuit current rating not less than the available fault current at the installed location as indicated on the drawings.

C. Mains: Configure for top or bottom incoming feed as indicated or as required for the installation.

D. Branch Overcurrent Protective Devices: Replaceable without disturbing adjacent devices.

E. Bussing: Sized in accordance with UL 67 temperature rise requirements.

1. Provide fully rated neutral bus unless otherwise indicated, with a suitable lug for each feeder or branch circuit requiring a neutral connection.

2. Provide solidly bonded equipment ground bus in each panelboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.

F. Conductor Terminations: Suitable for use with the conductors to be installed.

G. Enclosures: Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E.

1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:

a. Indoor Clean, Dry Locations: Type 1.

b. Outdoor Locations: Type 3R.

2. Boxes: Galvanized steel unless otherwise indicated.

a. Provide wiring gutters sized to accommodate the conductors to be installed.

3. Fronts:

a. Fronts for Surface-Mounted Enclosures: Same dimensions as boxes.

b. Fronts for Flush-Mounted Enclosures: Overlap boxes on all sides to conceal rough opening.

4. Lockable Doors: All locks keyed alike unless otherwise indicated.

H. Future Provisions: Prepare all unused spaces for future installation of devices including bussing, connectors, mounting hardware and all other required provisions.

I. Surge Protective Devices: Where factory-installed, internally mounted surge protective devices are provided in accordance with Section 26 4300, list and label panelboards as a complete assembly including surge protective device.

2.3 POWER DISTRIBUTION PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, power and feeder distribution type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase and Neutral Bus Material: Aluminum.

2. Ground Bus Material: Aluminum.

D. Circuit Breakers:

1. Provide bolt-on type.

E. Enclosures:

1. Provide surface-mounted enclosures unless otherwise indicated.

2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide clear plastic circuit directory holder mounted on inside of door.

2.4 LIGHTING AND APPLIANCE PANELBOARDS

A. Description: Panelboards complying with NEMA PB 1, lighting and appliance branch circuit type, circuit breaker type, and listed and labeled as complying with UL 67; ratings, configurations and features as indicated on the drawings.

B. Conductor Terminations:

1. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

2. Main and Neutral Lug Type: Mechanical.

C. Bussing:

1. Phase Bus Connections: Arranged for sequential phasing of overcurrent protective devices.

2. Phase and Neutral Bus Material: Aluminum.

3. Ground Bus Material: Aluminum.

D. Circuit Breakers: Thermal magnetic bolt-on type unless otherwise indicated.

E. Enclosures:

1. Provide surface-mounted or flush-mounted enclosures as indicated.

2. Fronts: Provide lockable hinged door with concealed hinges for access to overcurrent protective device handles without exposing live parts.

3. Provide clear plastic circuit directory holder mounted on inside of door.

2.5 OVERCURRENT PROTECTIVE DEVICES

A. Molded Case Circuit Breakers:

1. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.

2. Interrupting Capacity:

a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than:

b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.

3. Conductor Terminations:

a. Provide mechanical lugs unless otherwise indicated.

b. Provide compression lugs where indicated.

c. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.

4. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.

5. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.

a. Provide the following field-adjustable trip response settings:

1) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.

2) Long time delay.

3) Short time pickup and delay.

4) Instantaneous pickup.

6. Multi-Pole Circuit Breakers: Furnish with common trip for all poles.

7. Provide the following circuit breaker types where indicated:

a. Ground Fault Circuit Interrupter (GFCI) Circuit Breakers: Listed as complying with UL 943, class A for protection of personnel.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as indicated.

B. Verify that the ratings and configurations of the panelboards and associated components are consistent with the indicated requirements.

C. Verify that mounting surfaces are ready to receive panelboards.

D. Verify that conditions are satisfactory for installation prior to starting work.

3.2 INSTALLATION

A. Install products in accordance with manufacturer's instructions.

B. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

C. Provide required supports in accordance with Section 26 0529.

D. Install panelboards plumb.

E. Install flush-mounted panelboards so that trims fit completely flush to wall with no gaps and rough opening completely covered.

F. Mount panelboards such that the highest position of any operating handle for circuit breakers or switches does not exceed 79 inches above the floor or working platform.

G. Provide minimum of six spare 1 inch trade size conduits out of each flush-mounted panelboard stubbed into accessible space above ceiling and below floor.

H. Provide grounding and bonding in accordance with Section 26 0526.

I. Install all field-installed branch devices, components, and accessories.

J. Provide filler plates to cover unused spaces in panelboards.

K. Provide circuit breaker lock-on devices to prevent unauthorized personnel from de-energizing essential loads where indicated. Also provide for the following:

1. Fire detection and alarm circuits.

L. Identify panelboards in accordance with Section 26 0553.

3.3 FIELD QUALITY CONTROL

A. Test GFCI circuit breakers to verify proper operation.

B. Test shunt trips to verify proper operation.

3.4 ADJUSTING

A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.

B. Adjust alignment of panelboard fronts.

3.5 CLEANING

A. Clean dirt and debris from panelboard enclosures and components according to manufacturer's instructions.

B. Repair scratched or marred exterior surfaces to match original factory finish.

END OF SECTION

SECTION 26 2417 - SURGE PROTECTIVE DEVICES (SPDS)

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Low Voltage AC Surge Protection for Electrical Distribution Systems

1.2 REFERENCES

A. NFPA 70 - National Electrical Code, 2023 Edition

B. ANSI/UL 1449 - Third Edition

C. UL 1293

1.3 DEFINITIONS

A. Where items are shown as "lightning arrestor", "lightning suppressor", "surge arrestor", "arrestor", "suppressor", "transient voltage surge suppressor" (TVSS), or "surge suppressor", provide Surge Protective Device (SPD).

1.4 SUBMITTALS

A. See Section 26 0510- General Electrical Requirements, for submittal procedures.

B. Provide verification that the SPD complies with the required ANSI/UL 1449 3rd Edition listing by Underwriters Laboratories (UL). Compliance may be in the form of a file number that can be verified on UL's website, as long as the website contains the following information at a minimum: model number, SPD Type, system voltage, phases, modes of protection, Voltage Protection Rating (VPR), and Nominal Discharge Current (In).

C. For sidemount mounting applications (SPD mounted external to electrical assembly), electrical/mechanical drawings showing unit dimensions, weights, installation instruction details, and wiring configuration.

D. Product Data: Provide data sheets for each different component to be used.

1. Provide a list of device locations with the corresponding device type proposed.

2. Show that Surge Protective Devices (SPDs) and associated components are manufactured in the United States of America.

E. Submit a copy of the written guarantee.

F. Provide a letter stating that the manufacturer shall provide unit replacement within 48 hours of notification by the Owner with or without prior receipt of damaged parts.

G. Operating & Maintenance Data:

1. Submit the service organization name and phone number.

2. Operation and maintenance manuals shall be provided with each SPD shipped.

1.5 QUALITY ASSURANCE

A. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

B. SPD units and all components shall be designed, manufactured, and tested in accordance with the latest applicable UL standard (ANSI/UL 1449 3rd Edition).

1.6 WARRANTY

A. The manufacturer shall provide a full five (5) year warranty from the date of shipment against any SPD part failure when installed in compliance with manufacturer's written instructions and any applicable national or local code.

B. Warranty shall begin upon the date of final building acceptance by the Owner.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Square D

B. General Electric

C. Eaton

D. Siemens

2.2 VOLTAGE SURGE SUPPRESSION - GENERAL

A. Electrical Requirements:

1. Unit Operating Voltage - Refer to drawings for operating voltage and unit configuration.

2. Maximum Continuous Operating Voltage (MCOV) - The MCOV shall not be less than 125% of the nominal system operating voltage.

3. The suppression system shall incorporate thermally protected metal-oxide varistors (MOVs) as the core surge suppression component for the service entrance and all other distribution levels. The system shall not utilize silicon avalanche diodes, selenium cells, air gaps, or other components that may crowbar the system voltage leading to system upset or create any environmental hazards.

4. Protection Modes - The SPD must protect all modes of the electrical system being utilized. The required protection modes are:

a. Line-to-Neutral

b. Line-to-Ground

c. Line-to-Line

d. Neutral-to-Ground

5. Nominal Discharge Current (In) - All SPDs applied to the distribution system shall have a 20kA In rating regardless of their SPD Type (includes Types 1 and 2) or operating voltage. SPDs having an In less than 20kA shall be rejected.

6. ANSI/UL 1449 3rd Edition Voltage Protection Rating (VPR) - The maximum ANSI/UL 1449 3rd Edition VPR for the device shall not exceed the following:

a. 480Y/277 Volts:

1) L-N, L-G, N-G = 1200

2) L-L = 2000

b. 208Y/120 Volts:

1) L-N, L-G, N-G = 800

2) L-L = 1200

B. SPD Design:

1. Maintenance Free Design - The SPD shall be maintenance free and shall not require any user intervention throughout its life. SPDs containing items such as replaceable modules, replaceable fuses, or replaceable batteries shall not be accepted. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

2. Balanced Suppression Platform - The surge current shall be equally distributed to all MOV components to ensure equal stressing and maximum performance. The surge suppression platform must provide equal impedance paths to each matched MOV. Designs incorporating replaceable SPD modules shall not be accepted.

3. Electrical Noise Filter - Each unit shall include a high-performance EMI/RFI noise rejection filter. Noise attenuation for electric line noise shall be up to 30 dB from 10 kHz to 100 MHz using the MIL-STD-220A insertion loss test method. Products unable able to meet this specification shall not be accepted.

4. Internal Connections - No plug-in component modules or printed circuit boards shall be used as surge current conductors. All internal components shall be soldered, hardwired with connections utilizing low impedance conductors.

5. Monitoring Diagnostics - Each SPD shall provide the following integral monitoring options:

    a. Protection Status Indicators - Each unit shall have a green / red solid-state indicator light that reports the status of the protection on each phase.

        1) For wye configured units, the indicator lights must report the status of all protection elements and circuitry in the L-N and L-G modes. Wye configured units shall also contain an additional green / red solid-state indicator light that reports the status of the protection elements and circuitry in the N-G mode. SPDs that indicate only the status of the L-N and L-G modes shall not be accepted.

        2) For delta configured units, the indicator lights must report the status of all protection elements and circuitry in the L-G and L-L modes.

        3) The absence of a green light and the presence of a red light shall indicate that damage has occurred on the respective phase or mode. All protection status indicators must indicate the actual status of the protection on each phase or mode. If power is removed from any one phase, the indicator lights must continue to indicate the status of the protection on all other phases and protection modes. Diagnostics packages that simply indicate whether power is present on a particular phase shall not be accepted.

    b. Remote Status Monitor - The SPD must include Form C dry contacts (one NO and one NC) for remote annunciation of its status. Both the NO and NC contacts shall change state under any fault condition.

    c. Audible Alarm and Silence Button - The SPD shall contain an audible alarm that will be activated under any fault condition. There shall also be an audible alarm silence button used to silence the audible alarm after it has been activated.

    d. Surge Counter - The SPD shall be equipped with an LCD display that indicates to the user how many surges have occurred at the location. The surge counter shall trigger each time a surge event with a peak current magnitude of a minimum of 50 ± 20A occurs. A reset pushbutton shall also be standard, allowing the surge counter to be zeroed. The reset button shall contain a mechanism to prevent accidental resetting of the counter via a single, short-duration button press. In order to prevent accidental resetting, the surge counter reset button shall be depressed for a minimum of 2 seconds in order to clear the surge count total.

        1) The ongoing surge count shall be stored in non-volatile memory. If power to the SPD is completely interrupted, the ongoing count indicated on the surge counter's display prior to the interruption shall be stored in non-volatile memory and displayed after power is restored. A backup battery may also be utilized in order to achieve this functionality.

6. Overcurrent Protection - The unit shall contain thermally protected MOVs. These thermally protected MOVs shall have a thermal protection element packaged together with the MOV in order to achieve overcurrent protection of the MOV. The thermal protection element shall disconnect the MOV(s) from the system in a fail-safe manner should a condition occur that would cause them to enter a thermal runaway condition.

7. Fully Integrated Component Design - All of the SPD's components and diagnostics shall be contained within one discrete assembly. SPDs or individual SPD modules may be ganged together in order to achieve higher surge current ratings.

8. Safety Requirements:

   a. The SPD shall minimize potential arc flash hazards by containing no user serviceable / replaceable parts and shall be maintenance free. Replaceable modules are acceptable. SPDs requiring any maintenance of any sort such as periodic tightening of connections shall not be accepted. SPDs requiring user intervention to test the unit via a diagnostic test kit or similar device shall not be accepted.

   b. SPDs designed to interface with the electrical assembly via conductors shall require no user contact with the inside of the unit. Such units shall have any required conductors be factory installed.

2.3 SYSTEM APPLICATION

A. The SPD applications covered under this section include distribution and branch panel locations, busway, motor control centers (MCC), switchgear, and switchboard assemblies. All SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C, B, and A environments.

B. Surge Current Capacity - The minimum surge current capacity the device is capable of withstanding (based on ANSI/IEEE C62.41 location category) shall be as follows:

1. Category C (Service Entrance Locations - Switchboards):

   a. Per Phase - 240 kA

   b. Per Mode - 120 kA

2. Category B (High Exposure Rooftop Locations and Distribution Panelboards):

   a. Per Phase - 160 kA

   b. Per Mode - 80 kA

3. Category A (Branch Locations - Panelboards):

   a. Per Phase - 120 kA

   b. Per Mode - 60 kA

C. SPD Type - all SPDs installed on the line side of the service entrance disconnect shall be Type 1 SPDs. All SPDs installed on the load side of the service entrance disconnect shall be Type 1 or Type 2 SPDs.

2.4 LIGHTING AND DISTRIBUTION PANELBOARD REQUIREMENTS

A. The SPD application covered under this section includes lighting and distribution panelboards. The SPD units shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category B environments.

1. The SPD shall not limit the use of through-feed lugs, sub-feed lugs, and sub-feed breaker options.

2. SPDs shall be installed immediately following the load side of the main breaker. SPDs installed in main lug only panelboards shall be installed immediately following the incoming main lugs.

3. The panelboard shall be capable of re-energizing upon removal of the SPD.

4. The SPD shall be interfaced to the panelboard via a direct bus bar connection. Alternately, an SPD connected to a 30A circuit breaker for disconnecting purposes may be installed using short lengths of conductors as long as the conductors originate integrally to the SPD. The SPD shall be located directly adjacent to the 30A circuit breaker.

5. The SPD shall be included and mounted within the panelboard by the manufacturer of the panelboard.

6. Sidemount Mounting Applications Installation (SPD mounted external to electrical assembly): Lead length between the breaker and suppressor shall be kept as short as possible to ensure optimum performance. Any excess conductor length shall be trimmed in order to minimize let-through voltage. The installer shall comply with the manufacturer's recommended installation and wiring practices.

2.5 SWITCHGEAR / SWITCHBOARD, MCC, AND BUSWAY REQUIREMENTS

A. The SPD application covered under this section is for switchgear, switchboard, MCC, and busway locations. Service entrance located SPDs shall be tested and demonstrate suitability for application within ANSI/IEEE C62.41 Category C environments.

1. Locate the SPD on the load side of the main disconnect device, as close as possible to the phase conductors and the ground/neutral bar.

2. The SPD shall be connected through a disconnect (30A circuit breaker). The disconnect shall be located in immediate proximity to the SPD. Connection shall be made via bus, conductors, or other connections originating in the SPD and shall be kept as short as possible.

3. The SPD shall be integral to switchgear, switchboard, MCC, and/or bus plug as a factory standardized design.

4. All monitoring and diagnostic features shall be visible from the front of the equipment.

2.6 ENCLOSURES

A. All enclosed equipment shall have NEMA 1 general purpose enclosures, unless otherwise noted. Provide enclosures suitable for locations as indicated on the drawings and as described below:

1. NEMA 1 - Constructed of a polymer (units integrated within electrical assemblies) or steel (sidemount units only), intended for indoor use to provide a degree of protection to personal access to hazardous parts and provide a degree of protection against the ingress of solid foreign objects (falling dirt).

2. NEMA 4 - Constructed of steel intended for either indoor or outdoor use to provide a degree of protection against access to hazardous parts; to provide a degree of protection of the equipment inside the enclosure against ingress of solid foreign objects (dirt and windblown dust); to provide a degree of protection with respect to the harmful effects on the equipment due to the ingress of water (rain, sleet, snow, splashing water, and hose directed water); and that will be undamaged by the external formation of ice on the enclosure. (sidemount units only).

3. NEMA 4X - Constructed of stainless steel providing the same level of protection as the NEMA 4 enclosure with the addition of corrosion protection. (sidemount units only)

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Surface or Flush Mounted Panelboards with Exterior SPDs: Mount SPDs on the side or bottom of the panelboard, closest to the serving breaker. Make leads as short and straight as possible.

C. Provide multi-pole, 30 Amp breaker as a dedicated disconnect for SPD unless otherwise indicated on drawings. Provide breakers for ALL SPDs.

D. Tighten electrical connectors and terminals according to manufacturer’s published torque-tightening values.

3.2 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality control testing:

1. After installing the Surge Protection Device, but before electrical circuitry has been energized, test for compliance with requirements.

2. Complete start-up checks and voltage verifications according to manufacturer's written instructions.

3. Perform visual and mechanical inspection on each unit. Certify that units are installed per manufacturer's recommendations.

B. Repair or replace malfunctioning units. Retest after repairs or replacements are made.

END OF SECTION

SECTION 26 2726 - WIRING DEVICES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Wall switches.

B. Receptacles.

C. Floor box service fittings.

D. Poke-through assemblies.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.3 ADMINISTRATIVE REQUIREMENTS

A. Coordination:

1. Coordinate the placement of outlet boxes with millwork, furniture, equipment, etc. installed under other sections or by others.

2. Coordinate wiring device ratings and configurations with the electrical requirements of actual equipment to be installed.

3. Coordinate the installation and preparation of uneven surfaces, such as split face block, to provide suitable surface for installation of wiring devices.

4. Coordinate the core drilling of holes for poke-through assemblies with the work covered under other sections.

5. Notify the Design Professional of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's catalog information showing dimensions, colors, and configurations.

C. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

PART 2 PRODUCTS

2.1 GENERAL:

A. Different type devices shall match in color. Receptacles, light switches, low voltage switches, wall mounted occupancy sensors, etc. shall be the same color with the same type of trim or cover. Provide submittals data indicating this color prior to purchasing.

2.2 WIRING DEVICE APPLICATIONS

A. Provide wiring devices suitable for intended use and with ratings adequate for load served.

B. For single receptacles installed on an individual branch circuit, provide receptacle with ampere rating not less than that of the branch circuit.

C. Provide weather resistant GFI receptacles with specified weatherproof covers for all receptacles installed outdoors or in damp and wet locations.

D. Provide tamper resistant receptacles for all receptacles installed in areas of the building accessible to the general public.

E. Provide GFI protection for all receptacles installed within 6 feet of sinks.

F. Provide GFI protection for all receptacles installed in kitchens.

G. Provide GFI protection for all receptacles serving electric drinking fountains.

H. Unless noted otherwise, do not use combination switch/receptacle devices.

2.3 WIRING DEVICE FINISHES:

A. Provide wiring device finishes as described below unless otherwise indicated.

B. Coordinate Wiring Device finish color with the Architect. Plates shall be stainless steel.

C. Wiring Devices Installed in Wet or Damp Locations: Ivory with specified weatherproof cover.

D. Wiring Devices Connected to Emergency Power: Red with stainless steel wall plate.

2.4 WALL SWITCHES

A. All Wall Switches: AC only, quiet operating, general-use snap switches with silver alloy contacts, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 20and where applicable FS W-S-896; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring and screw actuated binding clamp for back wiring with separate ground terminal screw.

B. Standard Wall Switches: Industrial specification grade, 20 A, 120/277 V with standard toggle type switch actuator and maintained contacts; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

C. Lighted Wall Switches: Industrial specification grade, 20 A, 120/277 V with illuminated standard toggle type switch actuator and maintained contacts; illuminated with load off; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

D. Pilot Light Wall Switches: Industrial specification grade, 20 A, 120/277 V with red illuminated standard toggle type switch actuator and maintained contacts; illuminated with load on; single pole single throw, double pole single throw, three way, or four way as indicated on the drawings.

E. Switch Types: Single pole, double pole, 3-way, 4-way, pilot gang, and key.

1. Single Pole Switches:

    a. Cooper 2221

    b. Hubbell HBL1221

    c. Leviton 1221-2

    d. P&S PS20AC1

2. Double Pole Switches:

    a. Cooper 2222

    b. Hubbell HBL1222

    c. Leviton 1222-2

    d. P&S PS20AC2

3. 3-Way Switches:

    a. Cooper 2223

    b. Hubbell HBL1223

    c. Leviton 1223-2

    d. P&S PS20AC3

4. 4-Way Switches:

    a. Cooper 2224

    b. Hubbell HBL1224

c. Leviton 1224-2

d. P&S PS20AC4

5. Pilot Gang (provide for lighting control of all Janitor's closets, closets, and storage spaces where the switch is located outside the space):

a. Cooper 2221PL

b. Hubbell HBL1221PL

c. Leviton 1221-PL

d. P&S PS20AC1-RPL7

6. Key:

a. Cooper 2221L

b. Hubbell HBL1221L

c. Leviton 1221-2L

d. P&S PS20AC1-L

2.5 RECEPTACLES

A. Manufacturers:

1. Hubbell Incorporated: www.hubbell.com/#sle.

2. Leviton Manufacturing Company, Inc: www.leviton.com/#sle.

3. Pass & Seymour, a brand of Legrand North America, Inc: www.legrand.us/#sle.

B. All Receptacles: Self-grounding, complying with NEMA WD 1 and NEMA WD 6, and listed as complying with UL 498and where applicable FS W-C-596; types as indicated on the drawings.

1. Wiring Provisions: Terminal screws for side wiring or screw actuated binding clamp for back wiring with separate ground terminal screw.

2. NEMA configurations specified are according to NEMA WD 6.

C. Convenience Receptacles:

1. Standard Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R; single or duplex as indicated on the drawings.

2. Isolated Ground Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, with ground contacts isolated from mounting strap; isolated ground triangle mark on device face; single or duplex as indicated on the drawings.

3. Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

4. Tamper Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, , listed and labeled as tamper resistant type; single or duplex as indicated on the drawings.

5. Tamper Resistant and Weather Resistant Convenience Receptacles: Industrial specification grade, 20A, 125V, NEMA 5-20R, , listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations; single or duplex as indicated on the drawings.

D. GFI Receptacles:

1. Standard GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style.

2. Weather Resistant GFCI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as weather resistant type complying with UL 498 Supplement SD suitable for installation in damp or wet locations.

3. Tamper Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type.

4. Tamper Resistant and Weather Resistant GFI Receptacles: Industrial specification grade, duplex, 20A, 125V, NEMA 5-20R, rectangular decorator style, listed and labeled as tamper resistant type and as weather resistant type complying with UL 498 Supplement SE suitable for installation in damp or wet locations.

E. USB Charging Devices:

1. USB Charging Devices - General Requirements: Listed as complying with UL 1310.

2. USB Charging/Tamper Resistant Receptacle Combination Devices: Two-port (Type A) USB charging device and receptacle, commercial specification grade, duplex, 20A, 125V, NEMA 5-20R, listed and labeled as tamper resistant type; rectangular decorator style.

2.6 WALL PLATES

A. All Wall Plates: Comply with UL 514D.

1. Configuration: One piece cover as required for quantity and types of corresponding wiring devices.

2. Size: Standard.

3. Screws: Metal with slotted heads finished to match wall plate finish.

4. All wall plates shall be stainless steel.

B. Stainless Steel Wall Plates: Brushed satin finish, Type 302 stainless steel.

C. Weatherproof Covers for Wet Locations: Gasketed, cast aluminum, with hinged lockable cover and corrosion-resistant screws; listed as suitable for use in wet locations while in use with attachment plugs connected and identified as extra-duty type.

2.7 FLOOR BOX SERVICE FITTINGS

A. Description: Service fittings compatible with floor boxes provided under Section 26 0537 with all components, adapters, and trims required for complete installation. Note: floorboxes must be flush with the floor, with less than 1/4" trim above the surrounding floor material. Anything greater than 1/4" shall be reworked to make flush. See plans for floorbox types.

2.8 POKE-THROUGH ASSEMBLIES

A. See plans for poke-thru type basis of design.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate devices and conductors in accordance with NFPA 70.

C. Verify that wall openings are neatly cut and will be completely covered by wall plates.

D. Verify that final surface finishes are complete, including painting.

E. Verify that floor boxes are adjusted properly.

F. Verify that branch circuit wiring installation is completed, tested, and ready for connection to wiring devices.

G. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of wiring devices provided under this section.

B. Install wiring devices in accordance with manufacturer's instructions.

C. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.

D. Where required, connect wiring devices using pigtails not less than 6 inches long. Do not connect more than one conductor to wiring device terminals.

E. Connect wiring devices by wrapping conductor clockwise 3/4 turn around screw terminal and tightening to proper torque specified by the manufacturer. Where present, do not use push-in pressure terminals that do not rely on screw-actuated binding.

F. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.

G. Provide GFI receptacles with integral GFI protection at each location indicated. Do not use feed-through wiring to protect downstream devices.

H. Where split-wired duplex receptacles are indicated, remove tabs connecting top and bottom receptacles.

I. Install in accordance with NECA "Standard of Installation."

J. Install wiring devices plumb and level with mounting yoke held rigidly in place.

K. Install wall switches with OFF position down.

L. Install wall dimmers to achieve full rating specified and indicated after derating for ganging as instructed by manufacturer.

M. Do not share neutral conductor on branch circuits utilizing wall dimmers.

N. Install vertically mounted receptacles with grounding pole on top and horizontally mounted receptacles with grounding pole on left.

O. Install wall plates to fit completely flush to wall with no gaps and rough opening completely covered without strain on wall plate. Repair or reinstall improperly installed outlet boxes or improperly sized rough openings. Do not use oversized wall plates in lieu of meeting this requirement.

P. Install blank wall plates on junction boxes and on outlet boxes with no wiring devices installed or designated for future use.

Q. Install poke-through closure plugs in all unused core holes to maintain fire rating of floor.

R. Install receptacles with grounding pole on bottom.

S. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.

T. Install wall plates on switch, receptacle, and blank outlets.

U. Install decorative plates on switch, receptacle, and blank outlets in finished areas.

V. Connect wiring devices by wrapping conductor around screw terminal.

W. Use jumbo size plates for outlets installed in masonry walls.

X. Install plates with all edges in contact with the finished wall.

Y. Install galvanized steel plates on outlet boxes and junction boxes in unfinished areas, above accessible ceilings, and on surface mounted outlets.

Z. Mount all plates vertically unless otherwise noted.

AA. Where two or more devices are shown adjacent, they shall be mounted in ganged boxes and covered with one faceplate.

BB. Install protective rings on active flush cover service fittings.

CC. Where outlets of different levels are shown adjacent, they shall be installed in one vertical line. Outlets shown back to back on a common wall shall be offset a minimum of 10 inches to dampen sound transmission through the wall.

DD. On all walls with 1 hour or greater fire rating, "back to back" outlets shall be installed a minimum of 24 inches apart. Mount with stud between outlets for gypboard constructed partitions.

EE. Where outlets are installed in unfinished block or tile partitions they shall be installed at the points in the tile to permit the face plate to cover the rough opening. The horizontal and vertical locations indicated may be altered to permit above installation. Contractor shall check the Architectural drawings to prevent conflicts when shifting locations.

FF. Provide GFI receptacles where located within 6' of a water source, and as shown on plans.

3.4 INTERFACE WITH OTHER PRODUCTS

A. Coordinate locations of outlet boxes provided under Section 26 0537 to obtain mounting heights specified.

B. Where outlets are shown above cabinets or casework, install outlet 6 inches above backsplash of counter.

C. Where the mounting height of an outlet is not shown on the plans or specifications, the contractor shall contact the Design Professional for exact mounting height requirements.

3.5 FIELD QUALITY CONTROL

A. Inspect each wiring device for damage and defects.

B. Operate each wall switch and wall dimmer with circuit energized to verify proper operation.

C. Operate each wall switch with circuit energized and verify proper operation.

D. Verify that each receptacle device is energized.

E. Test each receptacle device for proper polarity prior to final inspection.

F. Test each GFCI receptacle for proper tripping operation according to manufacturer's instructions.

G. Correct wiring deficiencies and replace damaged or defective wiring devices.

3.6 ADJUSTING

A. Adjust devices and wall plates to be flush and level.

3.7 CLEANING

A. Clean exposed surfaces to remove dirt, paint, or other foreign material and restore to match original factory finish.

END OF SECTION

SECTION 26 2813 - FUSES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fuses.

1.2 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.3 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

1.4 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

B. Products: Listed and classified by Underwriters Laboratories Inc. as suitable for the purpose specified and indicated.

1.5 MAINTENANCE MATERIALS

A. Furnish three of each size and type fuse installed.

PART 2 PRODUCTS

2.1 MANUFACTURERS

2.2 Manufacturers: Bussman, G.E., Ferraz Shawmut, Economy, Cefco, Cutler Hammer.

2.3 FUSES

A. Provide products listed, classified, and labeled as suitable for the purpose intended.

B. Unless specifically indicated to be excluded, provide fuses for all fusible equipment as required for a complete operating system.

C. Provide fuses of the same type, rating, and manufacturer within the same switch.

D. Comply with UL 248-1.

E. Use only fuses of voltage, amperage and class compatible with fuse holder or disconnect.

F. Dimensions and Performance: NEMA FU 1, Class as specified or indicated.

G. Voltage: Rating suitable for circuit phase-to-phase voltage.

H. Main Service Switches Larger than 600 amperes: Class L (time delay).

I. Disconnect Switches: 208 or 240V system U.L. Class RK-5, 250 volt rating with minimum interrupting capacity of 200,000 symmetrical amperes.

J. Disconnect Switches: 277/480V or 600V systems U.L. Class RK-5, 600 volt rating with minimum interrupting capacity of 200,000 symmetrical amperes.

PART 3 EXECUTION

3.1 INSTALLATION

A. Do not install fuses until circuits are ready to be energized.

B. Provide fuses in all fused devices. This shall include equipment of other trades.

C. Install fuses with label oriented such that manufacturer, type, and size are easily read.

END OF SECTION

SECTION 26 2816.16 - ENCLOSED SWITCHES

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Fusible switches.

B. Nonfusible switches.

1.2 RELATED REQUIREMENTS

A. Section 26 0526 - Grounding and Bonding for Electrical Systems.

B. Section 26 0529 - Hangers and Supports for Electrical Systems.

C. Section 26 2813 - Fuses.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

1.4 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide manufacturer's standard catalog pages and data sheets for enclosed switches and other installed components and accessories.

1.5 QUALITY ASSURANCE

A. Conform to requirements of NFPA 70.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Schneider Electric; Square D (basis of design).

B. ABB/GE.

C. Eaton.

D. Siemens.

2.2 COMPONENTS

A. Fusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.

2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.

3. Visible blades.

4. Non-teasible, positive, quick-make, quick-break mechanism.

5. Line terminal shields.

6. Fuse clips: Designed to accommodate NEMA FU1, Class R fuses.

B. Nonfusible Switch Assemblies: NEMA KS 1, Type HD enclosed load interrupter knife switch (H.P. Rated).

1. Externally operable handle interlocked to prevent opening front cover with switch in ON position.

2. Handle and switching mechanism integral with switch base, with easily recognizable position and lockable in OFF position.

3. Visible blades.

4. Non-teasible, positive, quick-make, quick-break mechanism.

5. Line terminal shields.

C. Enclosures: NEMA KS 1.

1. Interior Dry Locations: Type 1.

2. Exterior locations: Type 3R

PART 3 EXECUTION

3.1 INSTALLATION

A. Install enclosed switches in accordance with manufacturer's instructions.

B. Install enclosed switches securely, in a neat and workmanlike manner in accordance with NECA 1.

C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.

D. Provide required supports in accordance with Section 26 0529.

E. Install enclosed switches plumb.

F. Except where indicated to be mounted adjacent to the equipment they supply, mount enclosed switches such that the highest position of the operating handle does not exceed 79 inches above the floor or working platform.

G. Provide grounding and bonding in accordance with Section 26 0526.

H. Provide identification nameplate for each enclosed switch in accordance with Section 26 0553.

I. Provide arc flash warning labels in accordance with NFPA 70.

J. Install fuses in fusible disconnect switches.

K. Apply adhesive tag on inside door of each fused switch indicating NEMA fuse class and size installed.

END OF SECTION

SECTION 26 5100 - INTERIOR LIGHTING

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Interior luminaires.

B. Exit signs.

C. Ballasts and drivers.

1.2 RELATED REQUIREMENTS

A. Section 26 0923 - Lighting Control Devices.

B. Section 26 0923 - Lighting Control Devices: Automatic controls for lighting including occupancy sensors, outdoor motion sensors, time switches, outdoor photo controls, and daylighting controls.

1.3 REFERENCE STANDARDS

A. NFPA 70 - National Electrical Code, 2023 Edition.

B. NFPA 101 - Life Safety Code, 2018 Edition.

1.4 DESIGN INTENT

A. See plans.

B. Coordinate the installation of luminaires with mounting surfaces installed under other sections or by others. Coordinate the work with placement of supports, anchors, etc. required for mounting. Coordinate compatibility of luminaires and associated trims with mounting surfaces at installed locations.

C. Coordinate the placement of luminaires with structural members, ductwork, piping, equipment, diffusers, fire suppression system components, and other potential conflicts installed under other sections or by others.

D. Coordinate the placement of exit signs with furniture, equipment, signage or other potential obstructions to visibility installed under other sections or by others.

E. Notify the Design Professional of any conflicts or deviations from the contract documents to obtain direction prior to proceeding with work.

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Shop Drawings:

1. Indicate dimensions and components for each luminaire that is not a standard product of the manufacturer.

C. Product Data: Provide as specified.

1. LED Luminaires:

a. Include estimated useful life, calculated based on IES LM-80 test data.

b. Include IES LM-79 test report upon request.

D. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

E. Operation and Maintenance Data: Instructions for each product including information on replacement parts.

1.6 DELIVERY, STORAGE, AND PROTECTION

A. Receive, handle, and store products according to NECA/IESNA 500 (commercial lighting) and manufacturer's written instructions.

B. Keep products in original manufacturer's packaging and protect from damage until ready for installation.

1.7 FIELD CONDITIONS

A. Maintain field conditions within manufacturer's required service conditions during and after installation.

1.8 WARRANTY

A. Provide three year manufacturer warranty for all LED luminaires, including drivers.

B. Provide five year warranty for batteries for emergency lighting units.

C. Provide five year warranty for batteries for self-powered exit signs.

PART 2 PRODUCTS

2.1 LUMINAIRE TYPES

A. Furnish products as indicated in luminaire schedule included on the drawings.

2.2 LUMINAIRES

A. Unless otherwise indicated, provide complete luminaires including lamp(s) and all sockets, ballasts, reflectors, lenses, housings and other components required to position, energize and protect the lamp and distribute the light.

B. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, hardware, supports, trims, accessories, etc. as necessary for a complete operating system.

C. Provide products suitable to withstand normal handling, installation, and service without any damage, distortion, corrosion, fading, discoloring, etc.

D. Recessed Luminaires:

1. Ceiling Compatibility: Comply with NEMA LE 4.

2. Luminaires Recessed in Insulated Ceilings: Listed and labeled as IC-rated, suitable for direct contact with insulation and combustible materials.

3. Luminaires Recessed in Sloped Ceilings: Provide suitable sloped ceiling adapters.

4. Air-Handling Recessed Fluorescent Luminaires: Suitable for air supply/return, heat removal, or combination as indicated.

E. LED Luminaire Components: UL 8750 recognized or listed as applicable.

F. Track Lighting Systems: Provide track compatible with specified track heads, with all connectors, power feed fittings, dead ends, hangers and canopies as necessary to complete installation.

G. Luminaires Mounted in Continuous Rows: Provide quantity of units required for length indicated, with all accessories required for joining and aligning.

H. The Contractor shall verify all voltages to fixtures and shall furnish fixtures, ballasts, etc. compatible with voltages from panels serving fixtures.

2.3 EXIT SIGNS

A. Description: Exit signs and similar signs for special purpose applications such as area of refuge/rescue assistance.

B. All Exit Signs: Internally illuminated with LEDs unless otherwise indicated; complying with NFPA 101 and all applicable state and local codes, and listed and labeled as complying with UL 924.

1. Number of Faces: Single or double as indicated or as required for the installed location.

2. Directional Arrows: As indicated or as required for the installed location.

2.4 LED DRIVERS

A. Dimmable LED Drivers:

1. Dimming Range: Continuous dimming from 100 percent to five percent relative light output unless dimming capability to lower level is indicated, without flicker.

2. Control Compatibility: Fully compatible with the dimming controls to be installed.

    a. Wall Dimmers: See Section 26 2726.

    b. Daylighting Controls: See Section 26 0923.

PART 3 EXECUTION

3.1 EXAMINATION

A. Verify that field measurements are as shown on the drawings.

B. Verify that outlet boxes are installed in proper locations and at proper mounting heights and are properly sized to accommodate conductors in accordance with NFPA 70.

C. Verify that suitable support frames are installed where required.

D. Verify that branch circuit wiring installation is completed, tested, and ready for connection to luminaires.

E. Verify that conditions are satisfactory for installation prior to starting work.

3.2 PREPARATION

A. Provide extension rings to bring outlet boxes flush with finished surface.

B. Clean dirt, debris, plaster, and other foreign materials from outlet boxes.

3.3 INSTALLATION

A. Coordinate locations of outlet boxes provided under Section 26 0533.16 as required for installation of luminaires provided under this section.

B. Install products according to manufacturer's instructions.

C. Install luminaires plumb and square and aligned with building lines and with adjacent luminaires.

D. Suspended Ceiling Mounted Luminaires or Track:

1. Do not use ceiling tiles to bear weight of luminaires.

2. Secure surface-mounted, recessed, and pendant-mounted luminaires to building structure.

3. Secure lay-in luminaires to ceiling support channels using listed safety clips at four corners.

4. In addition to ceiling support wires, provide two galvanized steel safety wire(s) (minimum 18 gauge), connected from diagonal corners of each recessed luminaire to building structure.

5. For all track pieces, provide no more than 10' between supports to structure.

E. Suspended Luminaires:

1. Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

2. Install using the suspension method indicated, with support lengths and accessories as required for specified mounting height.

3. Stems shall not be less than 8-inches in length.

4. Fixtures shall be supported from structure.

5. Provide minimum of two supports for each luminaire, with no more than 4 feet between supports.

6. Install canopies tight to mounting surface.

7. Unless otherwise indicated, support pendants from swivel hangers.

8. No fixture shall be suspended using chain, unless specifically indicated on the plans.

F. Wall-Mounted Luminaires: Unless otherwise indicated, specified mounting heights are to bottom of luminaire.

G. Install accessories furnished with each luminaire.

H. Bond products and metal accessories to branch circuit equipment grounding conductor.

I. Exit Signs:

1. Unless otherwise indicated, connect unit to unswitched power from same circuit feeding normal lighting in same room or area. Bypass local switches, contactors, or other lighting controls.

J. Identify luminaires connected to emergency power system in accordance with Section 26 0553.

K. Locating Light Fixtures in Mechanical Equipment Spaces: The Contractor shall adjust fixture locations to avoid conflicts with ducts, piping, and equipment. Locate fixtures below and clear of ducts, pipes, and equipment. Fixtures shall not conflict with required access to duct, piping, and equipment, including but not limited to valves, instruments, and access doors. The Contractor shall relocate fixtures deemed to have conflicts at the discretion of the Design Professional.

L. Wall mounted exit signs shown over doors:

1. Atriums, lobbies or corridors with high ceilings, storefront: Confirm location and mounting height with A/E prior to rough-in of these areas.

2. Other locations:

a. If the ceiling is 12' or lower, locate the exit sign centered between the top of the door frame and the ceiling. All exit signs mounted over doors in the same space shall be at the same height.

b. If the ceiling is greater than 12', mount the exit sign such that the bottom of the sign is 7'-6" above finished floor.

M. For ceiling hung exit signs, hang via threaded rom down to the same level as the track lighting in the space. Rod shall be painted.

N. Any luminaire larger than 2' x 4' shall be supported independent of ceiling framing.

O. The Contractor shall verify all ceiling types and configuration prior to ordering fixtures. The Contractor shall review the reflected ceiling plan, including any changes or modifications to the documents made during construction. The Contractor shall furnish fixtures compatible with the ceiling type being installed.

P. Locate recessed ceiling luminaires as indicated on the reflected ceiling plan.

Q. Install surface mounted luminaries and exit signs plumb and adjust to align with building lines and with each other. Secure to prevent movement.

R. Install recessed luminaires to permit removal from below.

S. Install wall mounted fixtures at height indicated. Request this information prior to rough-in if no height is indicated.

T. Connect luminaires to branch circuit junction boxes provided under Section 26 0537 using flexible conduit. Support flexible conduit from structure. Flexible conduit shall not rest on ceiling tiles, and shall not rest on ceiling grid supports. Do not support flexible conduit from ceiling support wires. Do not support flex conduit from luminaire support wires.

U. Structural system attachments, unless noted otherwise:

1. Poured-in-place concrete or precast solid masonry: Concrete expandable anchors.

2. Steel Bar Joists or Steel Beams: 1 5/8-inch x 3/4-inch x 12 gauge channel bolted to top chords. Drill channel and secure threaded rod to channel

3. Along bar joist or steel beam center line: Malleable iron beam clamp.

3.4 FIELD QUALITY CONTROL

A. See Division 1 for additional quality requirements.

B. Inspect each product for damage and defects.

C. Operate each fixture after installation and connection. Inspect for proper connection and operation.

D. Correct wiring deficiencies and repair or replace damaged or defective products. Repair or replace excessively noisy ballasts as determined by the Design Professional.

3.5 ADJUSTING

A. Aim and position adjustable luminaires to achieve desired illumination as indicated or as directed by the Design Professional. Secure locking fittings in place.

B. Exit Signs with Field-Selectable Directional Arrows: Set as indicated or as required to properly designate egress path as directed by the Design Professional.

3.6 CLEANING

A. Clean electrical parts to remove conductive and deleterious materials.

B. Remove dirt and debris from enclosures.

C. Clean photometric control surfaces as recommended by manufacturer.

D. Clean finishes and touch up damage.

E. Replace any cracked or bent lenses or louvers. Replace any lenses or louvers with deficiencies as noted by the Design Professional.

3.7 CLOSEOUT ACTIVITIES

A. Demonstration: Demonstrate proper operation of luminaires to the Design Professional, and correct deficiencies or make adjustments as directed.

B. Just prior to Substantial Completion, replace all lamps that have failed.

3.8 PROTECTION

A. Protect installed luminaires from subsequent construction operations.

END OF SECTION

SECTION 26 5200 - SENSOR LIGHTING CONTROLS

PART 1 GENERAL

1.1 SECTION INCLUDES

A. Occupancy Sensors.

B. Indoor Daylight Light Level Controllers.

1.2 RELATED SECTIONS

A. Section 26 5100 - Interior Lighting.

1.3 REFERENCES

A. NFPA 70 - National Electrical Code, 2023 Edition; National Fire Protection Association.

1.4 SYSTEM DESCRIPTION

A. The objective of this section is to ensure the proper installation of the occupancy sensor based lighting control system so that lighting is turned off automatically after reasonable time delay when a room or area is vacated by the last person to occupy said room or area.

B. The occupancy sensor based lighting control shall accommodate all conditions of space utilization and all irregular work hours and habits.

C. Where applicable, occupancy sensors shall be wired in a "Manual ON/ Auto OFF" configuration.

D. Set the factory default to Auto OFF at 20 minutes.

1.5 SUBMITTALS

A. See Section 26 0510 - General Electrical Requirements, for submittal procedures.

B. Product Data: Provide product data sheets for all equipment to be used. Provide circuit diagrams of each type of device. Circuit diagrams shall indicate type of control wire and/or line voltage wire used.

C. Shop Drawings: Indicate layout of each interior space showing proper placement and aiming of occupancy sensor shown on the plans. Notify the Design Professional immediately of any possible conflicts with equipment / room layout shown on the plans. These drawings shall be produced using a CAD based program and submitted on full size (minimum "D" size) prints.

D. Product data shall clearly indicate method used to handle inrush current for all wall switch products.

E. Product data shall clearly state any load restrictions when used with electronic ballasts.`

F. Project Record Documents: Record actual locations of installed sensors and controls. Drawings shall include location of all power packs and low voltage wiring.

1.6 QUALITY ASSURANCE

A. The Contractor shall schedule an onsite meeting with an authorized factory agent to instruct the Contractor in proper mounting, adjustments and aiming of the occupancy sensors. This meeting shall take place prior to start of sensor installation.

B. Perform work in accordance with NFPA 70.

C. Manufacturer Qualifications: Company specializing in manufacturing products specified in this section, with not less than five years of documented experience.

D. All products shall be from the same manufacturer.

E. All components shall be U.L. listed.

F. Wall switch products shall be capable of withstanding the effects of inrush current.

1.7 WORK INCLUDED

A. The Contractor shall provide all labor, materials, tools, appliances, control hardware, sensors, wiring, junction boxes and equipment necessary for and incidental to the delivery, installation and furnishing of a completely operational occupancy sensor lighting control system, as shown on the plans and as described herein.

B. The Contractor shall coordinate all work described in this section with all other applicable plans and specifications, including but not limited to wiring, conduit, luminaires, HVAC systems and building management systems.

1.8 WARRANTY

A. Provide five year manufacturer warranty for all components.

B. Any equipment found to be damaged, defective or non-conforming shall be replaced at no additional cost to the owner.

1.9 EXTRA MATERIALS

A. Supply two additional power packs and one additional sensor of each type used for the Owner's use in maintenance of project.

PART 2 PRODUCTS

2.1 MANUFACTURERS

A. Occupancy Sensors:

1. Leviton

2. Hubbell

3. Acuity

4. Current

2.2 OCCUPANCY SENSORS

A. NOTE: 360 degree sensors are typically shown in the center of the space on the plans. Where ceiling mounted sensors are shown in the corners of spaces, these sensors should not be 360 degree, rather they should be designed for corner-room operation. The contractor and manufacturer shall coordinate this requirement and shall not provide a single type sensor for all applications. The plans show the type (infrared, ultrasonic, or combination) only. The location in the space should provide guidance as to the exact product to be chosen. Where sensors are to be mounted in the ceiling above 15 ft, use high density lenses to maintain sensitivity.

B. Note: Wall mounted occupancy sensors shall match line voltage switches in color. Provide decora style covers to match line voltage covers.

C. Note: Ceiling mounted occupancy sensors shall be white.

D. The passive infrared sensors shall be capable of detecting presence, in the control area, by detecting changes in the Infrared energy. Small movements shall be detected such as when a person is writing while seated at a desk.

E. All sensors shall have readily accessible, user adjustable settings for time delay and sensitivity. Settings shall be located on the sensor (not the control unit) and shall be recessed to limit tampering.

F. Wall switch sensors shall be capable of detection of occupancy at desktop level up to 300 square feet, and gross motion up to 1000 square feet.

G. Wall switch sensors shall accommodate loads from 0 to 800 watts at 120 volts; 0 to 1200 watts at 277 volts and shall have a 180 degree coverage capability.

H. Wall switch sensors shall include means of protecting the internal relay from the effects of inrush current.

I. Wall switch sensors shall have no leakage current to load, in manual or in Auto/Off mode for safety purposes and shall have voltage drop protection.

J. If an open circuit occurs in the AC line (such as a ballast or lamp failure), the sensor shall automatically switch to OFF mode.

K. In the event of a sensor failure, a bypass manual override shall be provided on each sensor. When bypass is utilized, lighting shall remain ON constantly or control shall divert to a wall switch until sensor is replaced. This control shall be recessed to prevent tampering.

L. Wall switch sensor shall have 2 positions only, OFF and AUTO, for normal operation.

M. Wall switch sensors shall provide a field selectable option to convert sensor operation from automatic-ON to manual-ON. Manual ON shall be the default.

N. Where specified, vandal resistant wall switch sensors shall utilize a hard lens with a minimum 1.0mm thickness. Products utilizing a soft lens will not be considered.

O. Passive infrared sensors shall have a multiple segmented Fresnel lens, in a multiple-tier configuration, with grooves-in to eliminate dust and residue build-up. The lens shall filter short wavelength IR such as those emitted by the sun and other visible light sources.

P. Ultrasonic sensing shall utilize Advanced Signal Processing to adjust the detection threshold dynamically to compensate for constantly changing levels of activity and airflow throughout controlled space.

Q. Ultrasonic operating frequency shall be crystal controlled to within plus or minus 0.01% tolerance to assure reliable performance and eliminate sensor cross-talk. Sensors using multiple frequencies are not acceptable.

R. Dual technology sensors shall consist of passive infrared and ultrasonic technologies for occupancy detection. Products that react to noise or ambient sound will not be considered.

S. For dual technology sensors, detection verification of BOTH technologies must occur in order to activate lighting systems. Upon verification, detection by either shall hold lighting on.

T. Dual technology sensors shall have a retrigger feature in which detection by either technology shall retrigger the lighting system on within 5 seconds of being switched off.

U. All sensors used in the center of a space shall provide for 360 degrees of coverage.

V. Sensors shall be capable of being wired in parallel to allow coverage of large areas.

W. To avoid false ON activations and to provide high sensitivity to minor motion, Pulse Count Processing and Detection Signature Analysis shall be used to examine the frequency, duration, and amplitude of a signal, to respond only to those signals caused by human motion.

X. Sensor shall incorporate field-selectable logic configurations which allows for space utilization changes and/or other special field conditions.

Y. Where specified, passive infrared and dual technology sensors shall offer daylighting foot candle adjustment control and be able to accommodate dual level lighting.

Z. All sensors shall be capable of operating normally with electronic ballasts, PL lamp systems and rated motor loads.

AA. Coverage of sensors shall remain constant after sensitivity control has been set. No automatic reduction shall occur in coverage due to the cycling of air conditioner or heating fans.

BB. All sensors shall provide an LED as a visual means of indication at all times to verify that motion is being detected during both testing and normal operation.

CC. Power packs for sensors shall have an internal, additional isolated relay with Normally Open, Normally Closed and Common outputs for use with HVAC control, Data Logging and other control options. Sensors utilizing separate components or specially modified units to achieve this function are not acceptable.

2.3 CIRCUIT CONTROL HARDWARE (POWER PACKS)

A. Control units shall be capable of external mounting through a 1/2" knock-out on a standard electrical enclosure. Unit shall be rated for plenum installation.

B. The control unit shall be an integrated, self-contained unit consisting internally of an isolated load switching control relay and a transformer to power the sensor.

C. Each control unit shall be capable of powering a minimum of two occupancy sensors.

D. Relay contacts shall have ratings of:

1. 13A - 120 VAC Tungsten

2. 20A - 120 VAC Ballast

3. 20A - 277 VAC Ballast

E. Control wiring between sensors and control units shall be Class II, 18-24 AWG, stranded U.L. Classified, PVC insulated or TEFLON jacketed cable suitable for use in plenums.

F. Minimum acceptable wire gauge from the circuit control hardware relays shall be #14 AWG.

2.4 INDOOR DAYLIGHT LIGHT LEVEL CONTROLLER

A. Provide indoor daylight light level controllers where shown and preset to footcandle level at 40-foot candles.

B. The light level controller shall be capable of detecting changes in lighting levels. The light level controller shall utilize an internal photo conductive cell to measure light levels.

C. The light level controller shall be capable of controlling any type of lighting. It shall be a self-contained device. Unit shall contain power supplies, contacts and all accoutrements to control one 20 ampere lighting circuit(s). Unit power shall be derived from the lighting branch circuit.

D. The light level controller shall be capable of turning lighting on and off between 10 and 200 footcandles for low lighting levels and between 50 and 1000 footcandles for brighter areas.

E. The light level controller shall have an adjustable deadband feature with a 1 to 3 ratio to prevent the cycling of lighting with minor lighting level changes.

F. The light level controller shall have an adjustable time delay range of 3 seconds to 5 minutes minimum to prevent cycling on and off during momentary lighting changes.

G. The light level controller shall have LED's to indicate the status of the sensor.

H. Each sensor shall be furnished with a by-pass provision to enable override of the sensor in case of a failure. Sensor shall have a minimum 5 year warranty.

PART 3 EXECUTION

3.1 INSTALLATION

A. Install in accordance with manufacturer's instructions.

B. Locate and aim sensors to provide complete and proper volumetric coverage within the manufacturer's specified range of coverage.

C. Spaces shall have 90% - 100% coverage to completely cover the controlled area, accommodating all occupancy habits of single or multiple occupants at any location within the room(s).

D. The location of sensors shown on the plans are diagrammatic only. Locate sensors to avoid interference with possible obstructions.

E. Locate sensors a minimum of 6 feet from and HVAC supply diffuser or return grille.

F. Provide all power/switch packs required to make the system fully functional. Usually, a minimum of one power/switch pack is required per circuit and/or area of control. However in some cases additional power/switch packs may be required. Contact manufacturer for final determination of power/switch packs required for this project.

G. Locate power/switch packs on wall above ceiling directly over the standard wall switch where possible.

H. Wall switches shown in spaces with occupancy sensors shall be wired to override the sensor so that the lights can be switched off manually.

I. In spaces shown with multiple sensors, wire the sensors in parallel so that either sensor can control all of the fixtures on that circuit.

J. Mount ceiling type devices in the center of a ceiling tile.

3.2 STARTING EQUIPMENT AND SYSTEMS

A. Occupancy Based Lighting Control - System Commissioning:

1. Upon completion of the installation, the system shall be completely commissioned by the manufacturer's factory authorized technician who will verify all adjustments and sensor placement to ensure a trouble-free occupancy-based lighting control system.

2. If multiple trips by the factory technician is required because the system is not operational or completely installed - it is the contractors responsibility to pay for additional service trips.

3. The Contractor shall provide both the manufacturer and the Design Professional a written notice of the scheduled commissioning date at least 15 working days prior to the scheduled date.

4. Upon completion of the system fine tuning the factory authorized technician shall provide proper training to the Owner in the adjustment and maintenance of the sensors.

5. The Contractor shall provide all lifts and/or ladders and one technician to assist in the commissioning.

6. Prior to commissioning, the Contractor shall verify that all sensors and associated power supplies/relays are installed and all wiring properly terminated.

7. The manufacturer's factory authorized technician shall, upon completion of the commissioning, provide a written report to the Contractor and the Design Professional indicating completion of the work. This report shall also indicate any corrective actions required on the part of the Contractor.

END OF SECTION

SECTION 27 00 00
COMMUNICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of General Requirements/Provisions shall be considered a part of this section and shall have the same force as if printed herein full. In addition, all information related to communications infrastructure that is documented in the architectural, structural, mechanical, and electrical drawings/documents shall be included as part of the Communications documents.

1.02 QUALITY ASSURANCE

A. Specifications, Standards and Codes: All work shall be in accordance with the following:

1. The 2020 edition of the National Electrical Code (NFPA 70)
2. American National Standards Institute (ANSI)
3. National Electrical Manufacturers Association (NEMA)
4. Telecommunications Industries Association (TIA)
5. Electronic Industries Association (EIA)
6. Institute of Electrical & Electronics Engineers (IEEE)
7. Underwriters Laboratories (UL)
8. American Standards Association (ASA)
9. Federal Communications Commission (FCC)
10. Occupational Safety and Health Administration (OSHA)
11. American Society of Testing Material (ASTM)
12. Americans with Disabilities Act (ADA)
13. Local city and county ordinances governing electrical work
14. In the event of conflicts, the more stringent provisions shall apply.

1.03 SCOPE

A. The work to be done under this section of the Specifications shall include furnishing labor, material, equipment and tools required for the complete installation of the work indicated on the Drawings or as specified herein.

B. All materials, obviously a part of the Communications Infrastructure and necessary to its proper operation, but not specifically mentioned or shown on the Drawings, shall be furnished and installed without additional charge.

C. The Drawings and Specifications are complementary to each other and what is called for by one shall be as binding as if called for by both. If a discrepancy exists between the Drawing and Specifications, the higher cost shall be included, and the engineer shall be notified of the discrepancy.

1.04 WORK INCLUDED

The Communications Infrastructure installed and work performed under this Division of the Specifications shall include but not necessarily be limited to the following:

A. Voice/Data Cabling Infrastructure

B. Fiber Optic Backbone

C. Communications conduits, raceways, cable tray, racks, cabinets and equipment mounting boards

D. Grounding and Bonding

E. Faceplates, Cable Identification, Fire Stopping

F. Underground raceway excavation, backfill, and compaction

G. Concrete work for duct banks, maintenance holes, handholes, vaults and restoration (where applicable)

1.05DEFINITIONS

A. Terms: The following definitions of terms supplement those of the General Requirements and are applicable to Division 27 - Communications:

B. Provide: As used herein shall mean “furnish, install and test (if applicable) complete.”

C. Infrastructure: As used herein shall mean cable, conduit, raceway, cable tray or j-hooks with all required boxes, fittings, connectors, and accessories; completely installed.

D. Work: As used herein shall be understood to mean the materials completely installed, including the labor involved.

1.06DRAWINGS

A. Drawings are generally diagrammatic and show the arrangement and location of pathways, outlets, support structures and equipment. The Contractor shall carefully investigate the structural and finish conditions affecting his work and arrange his work accordingly. Should conditions on the job make it necessary to make adjustments to pathways or materials, the Contractor shall so advise the Engineer and secure approval before proceeding with such work.

B. Where exact locations are required by equipment for stubbing-up and terminating conduit concealed in floor slabs, the Contractor shall request shop drawings, equipment location drawings, foundation drawings, and any other data required by him to locate the concealed conduit before the floor slab is poured.

C. Materials, equipment or labor not indicated but which can be reasonably inferred to be necessary for a complete installation shall be provided. Drawings and Specifications do not undertake to indicate every item of material, equipment, or labor required to produce a complete and properly operating installation.

D. The right is reserved to make reasonable changes in locations of equipment indicated on Drawings prior to rough-in without increase in contract cost.

E. The Contractor shall not reduce the size or number of conduit runs indicated on the Drawings without the written approval of the Engineer.

F. Any work installed contrary to Contract Drawings shall be subject to change as directed by the Engineer, and no extra compensation will be allowed for making these changes.

G. The location of equipment, support structures, outlets, and similar devices shown on the Drawings are approximate only. Do not scale Drawings. Obtain layout dimensions for equipment from Architectural plans unless indicated on Communications plans.

H. Schematic diagrams shown on the Drawings indicate the required functions only. The technology of a particular manufacturer may be used to accomplish the functions indicated without exact adherence to the schematic Drawings shown. Additional labor and materials required for such deviations shall be furnished at the Contractor's expense.

I. Verify the ceiling type, ceiling suspension systems, and clearance above hung ceilings prior to ordering cabling and associated hardware. Notify the Engineer of any discrepancies.

J. Review all architectural drawings for modular furniture.

K. Portions of these Drawings and Specifications are abbreviated and may include incomplete sentences. Omissions of words or phrases such as “the Contractor shall,” “shall be,” “as indicated on the Drawings,” “In accordance with,” “a,” “the” and “all are intended” shall be supplied by inference.

1.07SUBMITTALS

A. Submit for approval, details of all materials, equipment and systems to be furnished. Work shall not proceed without the Owner and/or the Project Manager's approval of the submitted items. Three (3) copies of the following shall be submitted:

1. Submittals for individual systems and equipment assemblies that consist of more than one item or component shall be made for the system or assembly as a whole. Partial submittals will not be considered, reviewed or stored, and such submittals will not be returned except at the request and expense of the Contractor.
2. Contractor shall generate shop drawings. Modify reviewed and accepted shop drawings to include revisions based upon completion of work. Submit shop drawings with record drawings on hard copy.
3. Shop drawings shall include equipment racks, patch panels, termination blocks, connection details, rack mounting details and any other details not included in the construction drawings.

B. Any materials and equipment listed that are not in accordance with Specification requirements may be rejected.

C. The approval of material, equipment, systems and shop drawings is a general approval subject to the Drawings, Specifications and verification of all measurements at the job. Approval does not relieve the Contractor from the responsibility of shop drawing errors. The Contractor shall carefully check and correct all shop drawings prior to submission for approval.

1.08QUALITY ASSURANCE

A. Equipment and materials required for installation under these Specifications shall be the current model and new (less than one [1] year from the date of manufacture), unused and without blemish or defect.

B. Equipment shall bear labels attesting to Underwriters Laboratories, where subject to label service. Manufacturers of equipment and materials pertinent to these items shall have been engaged in the manufacture of said equipment a minimum of three (3) years and, if so directed by the Owner, be able to furnish proof of their ability by submitting affidavits and descriptive data about their product including size and magnitude comparable to requirements specified herein.

1.09CONTRACTOR QUALIFICATIONS

A. The Contractor shall have total responsibility for the coordination and installation of the work shown and described in the Drawings and Specifications. The Contractor shall be a company specializing in the design, fabrication and installation of integrated communications systems.

B. Communications Systems specified shall be installed under the direction of a qualified Contractor. Qualification requirements shall include submittal by the Contractor to the Architect of the following:

1. List of previous projects of this scope, size and nature; including names and sizes of projects, description of work, time of completion and names of contact persons for reference.

C. Contractor must employ at least one (1) full-time Registered Communications Distribution Designer (RCDD). The RCDD shall be a W2 employee and not a subcontractor.

D. Contractor must be certified by Leviton to offer a LIMITED LIFETIME WARRANTY on the structured cabling plant. NO EXCEPTIONS.

1.10COORDINATION WITH OTHER TRADES

A. The Contractor shall coordinate communications work with that of other sections as required to ensure that the entire communications work will be carried out in an orderly, complete and coordinated fashion.

1.11SITE INVESTIGATION

A. Prior to submitting bids of the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems, shall be restored to their original condition before the completion of this project.

1.12PERMITS

A. Obtain all permits and inspections for the installation of this work and pay all charges incident thereto. Deliver to the Owner all certificates of said inspection issued by authorities having jurisdiction.

1.13RENOVATIONS AND ADDITIONS

A. All work that would adversely affect the normal operation of the other portions of the Owner's property shall be done at a time other than normal working hours. Normal working hours shall be considered 8 a.m. to 5 p.m. Monday through Friday.

B. Prior to submitting bids on the project, visit the site of the work to become aware of existing conditions that may affect the cost of the project.

C. Where work under this project requires extension, relocation, reconnections or modifications to existing equipment or systems, the existing equipment or systems shall be restored to their original and operating condition. Remove all equipment indicated to be demolished, including outlets, devices, raceways and support structures.

D. Care shall be exercised in the removal and storage of equipment indicated to be relocated or removed and reused. Prior to placing back into service, equipment shall be cleaned, and marred or chipped paint surfaces touched-up.

E. Provide all coring, cutting and patching to existing walls, floors, etc., required for the removal of existing work or the installation of new work.

PART 2 - PRODUCTS

2.01 SUBSTITUTIONS

A. Where equipment is identified by manufacturer and catalog number, it shall be as the base of requirements for quality and performance. Where manufacturers for equipment are identified by name, the Contractor may submit for approval, similar equipment of other manufacturers as substitution. The Engineer's decision as to whether the submitted equipment is acceptable shall be final and binding.

B. All changes necessary to accommodate the substituted equipment shall be made at the Contractor's expense, and shall be as approved by the Engineer. Detailed drawings indicating the required changes shall be submitted for approval at the time the substitution is requested.

C. If substitutions are made in lieu of device specified; form, dimension, design and profile shall be submitted to the Engineer for approval.

D. Submit request for approval of substitute materials in writing to the Architect at least ten days prior to bid opening.

2.02 MATERIALS

A. All materials used in this work shall be new and shall bear the inspection label of Underwriters' Laboratories Inc. or certification by other recognized laboratory.

B. The published standards and requirements of the Telecommunications Industries Association (TIA), National Electrical Manufacturers Association (NEMA), the American National Standard Institute (ANSI), the Institute of Electrical and Electronic Engineers (IEEE), and the American Society of Testing Materials (ASTM), are made a part of these Specifications and shall apply wherever applicable.

C. Materials and equipment furnished shall be of current production by manufacturers regularly engaged in the manufacture of such items, for which replacement parts are available.

D. When more than one unit of the same class of equipment or material is required, such units shall be the products of a single manufacturer or partner manufacturers that offer a certified solution.

E. Components of an assembled unit need not be products of the same manufacturer, but must offer a certified end-to-end solution.

F. Manufacturers of equipment assemblies, which include components made by others, shall assume complete responsibility for the final assembled unit.

G. Components shall be compatible with each other and with the total assembly for the intended service.

PART 3 - EXECUTION

3.01 EXAMINATION OF CONDITIONS

A. Prior to the start of work, the Contractor shall carefully inspect the installed work of other trades and verify that such work is complete to the point where installation may properly commence. Start of work indicates acceptance of conditions.

B. Install equipment in accordance with applicable codes and regulations, the original design and the referenced standards.

C. In the event of a discrepancy, immediately notify the Project Manager.

D. Do not proceed with installation until unsatisfactory conditions and discrepancies have been fully resolved.

3.02 PROTECTION OF SYSTEMS AND EQUIPMENT

A. Protect materials and equipment from damage during storage at the site and throughout the construction period. Equipment and materials shall be protected during shipment and storage against physical damage, dirt, theft, moisture, extreme temperature and rain.

B. Damage from rain, dirt, sun and ground water shall be prevented by storing the equipment on elevated supports and covering the sides with securely fastened protective rigid or flexible waterproof coverings.

C. During installation, equipment shall be protected against entry of foreign matter on the inside and be vacuum cleaned both inside and outside before testing, operating or painting.

D. As determined by the Project Manager, damaged equipment shall be fully repaired or shall be removed and replaced with new equipment to fully comply with requirements of the Contract Documents. Decision of the Project Manager shall be final.

E. Damaged paint on equipment and materials shall be repainted with painting equipment and finished with the same quality of paint and workmanship as used by the manufacturer.

3.03 ACCESS TO EQUIPMENT

A. Equipment shall be installed in location and manner that will allow convenient access for maintenance and inspection.

B. Working spaces shall be not less than specified in the National Electrical Code (NEC) for voltages specified.

C. Where the Project Manager determines that the Contractor has installed equipment not conveniently accessible for operation and maintenance, equipment shall be removed and reinstalled, one time only, as directed by the Project Manager, at no additional cost to the Owner. “Conveniently accessible” is defined as being capable of being reached without the use of ladders or without climbing or crawling under or over obstacles such as motors, pumps, belt guards, transformers, piping and duct work.

3.04 CLEANING

A. During construction, and prior to Owner acceptance of the building, remove from the premises and dispose of packing material and debris caused by communications work.

B. Remove dust and debris from interiors and exteriors of electrical equipment. Clean accessible current carrying elements prior to being energized.

3.05 COMPLETION

A. General: Upon completion of the work, remove excess debris, materials, equipment, apparatus, tools and similar items. Leave the premises clean, neat and orderly.

B. Results Expected: Systems shall be complete and operational and controls shall be set and calibrated. Testing, start-up and cleaning work shall be complete.

C. Maintenance Materials: Special tools for proper operation and maintenance of the equipment provided under this Specification shall be delivered to the Owner.

3.06 TESTING AND VERIFICATION

A. See specific Division 27 sections for testing parameters of sub-systems.

B. The Contractor shall verify that requirements of this Specification are met. Verification shall be through a combination of analyses, inspections, demonstrations and tests, as described below.

C. Verification by inspection includes examination of items and comparison of pertinent characteristics against the qualitative or quantitative standard set forth in the Specifications. Inspection may require moving or partially disassembling the item to accomplish the verification, included as part of the work at no additional cost to the Owner.

D. The Contractor shall verify by formal demonstrations or tests that the requirements of this Specification have been met. The Contractor shall demonstrate that the communications systems, components and subsystems meet Specification requirements in the “as-installed” operating environment during the “System Operation Test.” Even though no formal environmental testing is required, the Contractor shall measure and record temperature, humidity and other environmental parameters and the environmental conditions, which were encountered during the “System Operation Test.”

E. The Contractor shall carefully plan and coordinate the final acceptance tests so that tests can be satisfactorily completed. The Contractor shall provide necessary instruments, labor and materials required for tests, including the equipment manufacturer's technical representative and qualified technicians in sufficient numbers to perform the tests within a reasonable time period.

F. The Contractor shall satisfy all items detailed in the final acceptance check-off list (punch list). The list shall be a complete representation of specified installation requirements. At the time of final acceptance punch list items shall be corrected until the system is found to be acceptable to the Owner and the Project Manager.

G. After the Contractor systems have been installed and tested, the completed test plan shall be signed by the Communications Contractor Project Manager and submitted for approval.

END OF SECTION 270000
January 23, 2025

SECTION 27 05 10
FIRESTOPPING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Firestopping for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Firestopping Manufacturer(s)

1. STI Firestop Products (Firestop Devices, Putties, Caulks, Sealants, etc.)
2. Unique Firestop Products (Firestop Devices)

2.02 TYPES OF PRODUCTS

A. Sealants

1. Intumescent Firestop Sealants and Caulks
2. Latex Firestop Sealant
3. Acrylic Water-Based Sealant
4. Silicone Firestop Sealants and Caulks
5. Firestop Putty
6. Firestop Collars
7. Wrap Strips
8. 2-Part Silicone Firestop Foam
9. Firestop Mortar
10. Firestop Pillows
11. Elastomeric Spray
12. Accessories:

13. Forming/Damming Materials: Mineral fiberboard or other type as per manufacturer recommendation

B. Firestop Devices

1. Fire Rated Cable Pathway
   a. Fire rated cable pathway device modules shall be comprised of steel raceway with intumescent foam pads allowing 0-100 percent cable fill.

2.03 UL CLASSIFICATION

A. Thru-Wall Fitting - The firestop device for use in through-penetration firestop systems shall have been examined and tested by Underwriters Laboratories Inc. to UL1479 (ASTM E 814) and bear the U.S. and Canadian UL Classification Mark.

B. Threaded, Smooth and Split-Sleeve Firestop Devices - Firestopping sealants and devices shall be used together as a firestop system. All firestop systems shall bear a UL Classification system number. UL Classification system numbers are as follows:

1. Threaded Firestop System
   a. Block Wall - W-J-3049
   b. Dry Wall - W-L-3138
2. Threaded Firestop System (Vertical)
   a. Slab - F-A-3010
3. Smooth Firestop System
   a. Block Wall - W-J-3048
   b. Dry Wall - W-L-3137
4. Split-Sleeve Firestop System
   a. Block Wall - W-J-3047
   b. Dry Wall - W-L-3136

2.04 FIRESTOPPING SYSTEMS

A. Thru-Wall Fitting Firestop System:

1. The device shall be classified for use in one-, two-, three, and four-hour rated gypsum, concrete and block walls and provide a maximum L rating of six cfm. The devices shall also be tested by Underwriters Laboratories Inc. to UL2043 and determined to be suitable for use in air handling spaces.

B. Threaded, Smooth and Split-Sleeve Firestop Systems:

1. Shall conform to both Flame (F) and Temperature (T) ratings as required by local building codes and as tested by nationally accepted test agencies per ASTM E814 or UL 1479 fire tests in a configuration that is representative of field conditions.
2. The F rating must be a minimum of one (1) hour but not less than the fire resistance rating of the assembly being penetrated. T rating when required by code authority shall be based on measurement of the temperature rise on penetrating item(s). The fire test shall be conducted with a minimum positive pressure differential of 0.01 inches of water column.
3. For joints, must be tested to UL 2079 with movement capabilities equal to those of the anticipated conditions.

C. Firestopping materials and systems must be capable of closing or filling through-openings created by 1) the burning or melting of combustible pipes, cable jacketing, or pipe insulation materials, or 2) deflection of sheet metal due to thermal expansion (electrical & mechanical duct work).

D. Firestopping material shall be asbestos and lead free and shall not incorporate nor require the use of hazardous solvents.

E. Firestopping sealants must be flexible, allowing for normal pipe movement.

F. Firestopping materials shall not shrink upon drying as evidenced by cracking or pulling back from contact surfaces.

G. Firestopping materials shall be moisture resistant, and may not dissolve in water after curing.

PART 3 - EXECUTION

3.01 CONDITIONS REQUIRING FIRESTOPPING

A. General

1. Provide firestopping for conditions specified whether or not firestopping is indicated, and if indicated, whether such material is designed as insulation, safing, or otherwise.

B. Through-Penetrations

1. Firestopping shall be installed in all open penetrations and in the annular space in all penetrations in any bearing or non-bearing fire-rated barrier.

C. Membrane-Penetrations

1. Where required by code, all membrane-penetrations in rated walls shall be protected with firestopping products that meet the requirements of third-party time/temperature testing.

D. Construction Joints/Gaps

1. Firestopping shall be provided between the edges of floor slabs and exterior walls, between the tops of walls and the underside of floors, in the control joint in masonry walls and floors and in expansion joints.

E. Smoke-Stopping

1. As required by the other sections, smoke-stops shall be provided for through-penetrations, membrane-penetrations, and construction gaps with a material approved and tested for such application.

3.02 EXAMINATION

A. Examine the areas and conditions where firestops are to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with work until unsatisfactory conditions have been corrected.

B. Verify that environmental conditions are safe and suitable for installation of firestop products.

C. Verify that all pipes, conduit, cable, and other items that penetrate fire-rated construction have been permanently installed prior to installation of firestops.

3.03 INSTALLATION

A. General

1. Installation of firestops shall be performed by an applicator/installer qualified and trained by the manufacturer. Installation shall be performed in strict accordance with manufacturer's detailed installation procedures.
2. Apply firestops in accordance with fire test reports, fire resistance requirements, acceptable sample installations, and manufacturer's recommendations.
3. Unless specified and approved, all insulation used in conjunction with through-penetrants shall remain intact and undamaged and may not be removed.
4. Seal holes and penetrations to ensure an effective smoke seal.
5. In areas of high traffic, protect firestopping materials from damage. If the opening is large, install firestopping materials capable of supporting the weight of a human.
6. Insulation types specified in other sections shall not be installed in lieu of firestopping material specified herein.
7. All combustible penetrants (e.g. non-metallic pipes or insulated metallic pipes) shall be firestopped using products and systems tested in a configuration representative of the field condition.

B. Dam Construction

1. When required to properly contain firestopping materials within openings, damming or packing materials may be utilized. Combustible damming material must be removed after appropriate curing. Noncombustible damming materials may be left as a permanent component of the firestop system.

3.04 FIELD QUALITY CONTROL

A. Prepare and install firestopping systems in accordance with manufacturer's printed instructions and recommendations.

B. Follow safety procedures recommended in the Material Safety Data Sheets.

C. Finish surfaces of firestopping that are to remain exposed in the completed work to a uniform and level condition.

D. All areas of work must be accessible until inspection by the applicable Code Authorities.

E. Correct unacceptable firestops and provide additional inspection to verify compliance with this Specification.

3.05 CLEANING

A. Remove spilled and excess materials adjacent to firestopping without damaging adjacent surfaces.

B. Leave finished work in a neat and clean condition with no evidence of spill-overs or damage to adjacent surfaces.

3.06 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 05 10 – January 23, 2025

SECTION 27 05 26
GROUNDING AND BONDING FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Grounding and Bonding for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Grounding Conductor Manufacturer(s)

1. Southwire

B. Approved Grounding Lug Manufacturer(s)

1. Burndy
2. Thomas & Betts

C. Approved Grounding Busbar Manufacturer(s)

1. B-Line

2.02 GROUNDING CONDUCTORS

A. Grounding Conductor

1. Construction shall be Type THHN copper conductors, insulated with heat and moisture resistant PVC over which a UL listed jacket is applied.
2. Jacket color shall be green or black. Black jacketed cable shall be identified at each termination point with a wrap of green tape.

2.03 GROUNDING LUGS

A. Grounding Lugs and Hardware

1. Grounding lugs shall be 2-hole and installed with a crimper that when properly executed the die of the crimper impresses the die # on the lug base. All lugs shall be sleeved with clear heat-shrink to allow for inspection of the crimp. Silicon bronze or stainless-steel bolts and washers shall be used to install lugs to equipment. Exothermic welding is also allowed.

2.04 GROUNDING BUSBARS

A. Grounding Busbar

1. The grounding busbar shall be made of 1/4" thick solid copper.
2. The grounding busbar shall be installed with minimum clearance, 1" offsets and 1-1/2" insulators.
3. The grounding busbar shall accommodate 2-hole compression lugs.
4. The grounding busbar shall meet or exceed ANSI/TIA-607-B requirements.

PART 3 - EXECUTION

3.01 GROUNDING

A. The facility shall be equipped with a Communications Bonding Backbone (TBB). This backbone shall be used to ground all communications cable shields, equipment, racks, cabinets, raceways, and other associated hardware that has the potential to act as a current carrying conductor. The TBB shall be installed independent of the building's electrical and building ground and shall be designed in accordance with the recommendations contained in the ANSI/TIA-607-B Telecommunications Bonding and Ground Standard.

B. The main entrance facility/equipment room in each building shall be equipped with a telecommunications main grounding busbar (TMGB). Each telecommunications room (TR) shall be provided with a telecommunications ground busbar (TGB). The TMGB shall be connected to the building electrical entrance grounding facility.

C. All racks, metallic backboards, cable sheaths, metallic strength members, splice cases, cable trays, etc. entering or residing in the MC/IC/TC shall be grounded to the respective TGB or TMGB using a minimum #6 AWG stranded copper bonding conductor and compression lugs.

D. All wires used for communications grounding purposes shall be identified with a green insulation. Non-insulated wires shall be identified at each termination point with a wrap or green tape. All cables and busbars shall be identified and labeled in accordance with the ANSI/TIA-606-A.

E. See Section 27 05 43 - Underground Ducts and Raceways for Communications Systems for underground duct and raceway systems ground requirements.

3.02 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 05 26
January 23, 2025

SECTION 27 05 28
PATHWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Pathways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Rigid/Intermediate Conduit Manufacturer(s)

1. Allied
2. Wheatland

B. Non-Metallic (PVC) Manufacturer(s)

1. Allied
2. Cantex
3. Prime Conduit

C. Electrical Metallic Tubing (EMT) Manufacturer(s)

1. Allied
2. Wheatland

D. EMT Fittings Manufacturer(s)

1. Thomas & Betts
2. Steel City

E. Innerduct/Inner-Conduit Channel Manufacturer(s)

1. Carlon
2. Endot Industries
3. MaxCell
4. Eastern

F. Metallic Communications Outlet Box Manufacturer(s)

1. Steel City
2. Raco

G. Pull Box Manufacturer(s)

1. B-Line

H. Approved Cable Tray System Manufacturer(s)

1. B-Line

I. Approved Cable Hanger Manufacturer(s)

1. B-Line

J. Approved Tie Wrap/Velcro Strap Manufacturer(s)

1. Leviton

K. Approved Surface Mounted Raceway Manufacturer(s)

1. Coordinate with Division 26 (Electrical Contractor). Refer to Drawings.

2.02CONDUIT

A. Rigid and Intermediate Conduit

1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.

B. Non-Metallic (PVC) Conduit

1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC.
2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

C. Electrical Metallic Tubing (EMT)

1. Electrical metallic tubing (EMT), couplings and connectors shall be steel. Malleable iron, pressure-cast or die-cast fittings are not permitted.
2. Fittings for 2" EMT and smaller shall be steel set screw type, except where otherwise noted. Fittings for 2.5" and larger shall be steel set screw type with two (2) screws for connectors and four (4) screws for couplings. All connectors shall be insulated throat type.

D. Conduit Support

1. Individual conduit hangers shall be galvanized spring steel specifically designed for the purpose and sized appropriately for the conduit type and diameter. Support individual conduits 1-1/2 inch and smaller with 1/4-inch threaded steel rods and use 3/8-inch rods for 2 inch and larger.
2. Conduit support channels shall be 14 gauge galvanized (or equivalent treatment) channel sized for the amount of conduit to be supported. Channel suspension shall be 3/8" threaded steel rods. Attach suspension rods to structure with swivel type connectors. Conduit straps shall be spring steel type compatible with channel.
3. Conduit straps shall be single hole cast metal type or two-hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

E. Innerduct/Inner-Conduit Channel

1. Innerduct shall be corrugated plastic equipped with pull-string or mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
3. See Drawings for innerduct / inner-conduit channel (MaxCell) details.

2.03 METALLIC COMMUNICATIONS OUTLET BOXES

A. Metallic outlet boxes and device covers shall be galvanized steel not less than 1/16" thick.

B. The dimensions of the metallic outlet box shall be 4" x 4" square with a minimum depth of 2-1/8".

C. Metallic outlet boxes shall be equipped with single device covers (or two-device covers where needed). Where installed in plaster, gypsum board, etc., covers shall be raised to compensate for the thickness of the wall finish.

D. Where metallic outlet boxes are to be empty for future use, blank coverplates shall be used.

2.04 PULL BOXES

A. Pull boxes shall be constructed of galvanized steel with flat, removable covers fastened with plated steel screws.

B. Pull boxes shall be equipped with keyhole screw slots in the cover to permit removal of the cover without extracting the screws.

C. Pull boxes shall have provisions for grounding.

2.05 CABLE TRAY

A. Cable Tray System

1. Cable tray shall be steel or aluminum construction.
2. Cable tray cross members shall be factory welded at 12" intervals maximum.
3. Cable tray shall be equipped with one (1) or two (2) support rails that run the length of each segment.
4. End caps shall be installed on the exposed ends of the cable tray, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
5. Wall mount cable tray used in limited clearance areas shall be hook style and constructed of aluminum.
6. See Drawings for cable tray dimensions.
   a. Cable Tray color shall be black or clear.

2.06CABLE HANGERS

A. J-Hooks

1. J-hooks shall provide a bearing surface of sufficient width to comply with required bend radii of high-performance cables. J-hook shall be cULus Listed.
2. J-hooks shall have flared edges to prevent damage while installing cables.
3. J-hooks sized 1 5/16" and larger shall have a cable retainer strap to provide containment of cables within the hanger. The cable retainer strap shall be removable and reusable and be suitable for use in air handling spaces.

B. Adjustable Non-Continuous Cable Support Sling

1. Constructed from steel and woven laminate; sling length can be adjusted to hold up to 220 4-pair balanced twisted pair cables; rated for indoor use in non-corrosive environments. Rated to support Category 6 and higher cable, or optical fiber cable. Cable support sling shall be cULus Listed.
2. Adjustable non-continuous cable support sling shall have a static load limit of 20 lbs.
3. Adjustable non-continuous cable support sling shall be suitable for use in air handling spaces.

2.07TIE WRAPS AND VELCRO STRAPS

A. Tie Wraps and Velcro Straps

1. Cables shall be fastened to support structures with tie wraps/Velcro straps.
2. Tie wraps/Velcro straps installed in air handling spaces must be plenum rated.
   a. Non-plenum Tie Wrap color shall be black.
   b. Plenum Tie Wrap color shall be red.
   c. Non-plenum Velcro strap color shall be black.
   d. Plenum Velcro strap color shall be red.

2.08SURFACE MOUNTED RACEWAY

A. Surface Mounted Raceway

1. Coordinate with Division 26 (Electrical Contractor). Refer to Drawings.

PART 3 - EXECUTION

3.01PENETRATIONS

A. Holes through concrete and masonry in new and existing structures shall be cut with a diamond core drill or concrete saw upon approval of the structural engineer of record for the base of building. Pneumatic hammer, impact electric, hand or manual hammer type drills shall not be allowed, except where permitted by the Owner as required by limited working space. X-ray all floor penetrations accordingly.

B. Holes shall be located so as not to affect structural sections such as ribs or beams.

C. Holes shall be laid out in advance. The Owner shall be advised prior to drilling through structural sections, for determination of proper layout.

D. Structural Penetrations: Where conduits, wireways and other raceways pass through fire partitions, fire walls or walls and floors provide a code compliant effective barrier against the spread of fire, smoke and gases.

E. All penetrations where conduit is not used shall be sleeved.

F. No gaps or rough edges shall be allowed between wall and conduit/sleeve.

3.02CONDUIT SYSTEM

A. Conceal all conduits, except in unfinished spaces such as equipment rooms or as indicated by symbol on the Drawings.

B. Leave all empty conduits with a 200-pound test nylon cord pull line.

C. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.

D. Fasten conduit support device to structure with wood screws on wood, toggle bolts on hollow masonry, anchors as specified on solid masonry or concrete, and machine bolts, clamps, or spring steel clips, on steel.

E. Install conduit with wiring, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.

F. Conduit shall be run parallel or at right angles to existing walls, ceilings, and structural members.

G. Attach backbone conduits larger than one-inch trade diameter to or from structure on intervals not exceeding twelve feet with conduit beam clamps, one-hole conduit straps or trapeze type support.

H. Where conduits must pass through structural members obtain approval of Architect or Engineer.

I. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.

J. Provide expansion and deflection coupling where conduit passes over a building expansion joint.

K. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (G.R.S.) or intermediate metal conduit (IMC). Provide concrete encasement where required or as indicated on Drawings.

L. All other conduit, unless specified herein, shall be electrical metallic tubing (EMT). PVC conduit is not allowed in exposed or concealed areas, but only within concrete.

M. Conduit Installations Within Slab/Floor

1. Conduit shall be run following the most direct route between points.
2. Conduit shall not be installed in concrete where the outside diameter is larger than 1/3 of the slab thickness.
3. Conduits shall not be installed within shear walls unless specifically indicated on the Drawings. Conduit shall not be run directly below and parallel with load bearing walls.

4. Protect each metallic conduit installed in concrete slab or conduits 1-1/2 inch and smaller passing through a concrete slab against corrosion where conduit enters and leaves concrete by wrapping conduit with vinyl all-weather electrical tape.
5. Protect all conduits entering and leaving concrete floor slabs from physical damage during construction.
6. Provide expansion fittings in all conduits where length or run exceeds 200 feet or where conduits pass through building expansion joints.
7. Install all conduits penetrating or routed within rated fire floors to maintain the fire rating of the floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
8. Conduits installed within concrete floor slabs which are in direct contact with grade or which penetrate the building roof shall be galvanized rigid steel (G.R.S.), intermediate metal conduit (I.M.C.) or Schedule 40, heavy wall PVC.

N. Communications cables shall not occupy conduits with power cables.

O. Metallic conduits shall be grounded in accordance with ANSI/TIA-607-B.

P. Conduit runs shall not have more than two (2) 90-degree bends between pull points.

Q. Communications conduit system shall contain no condulets (also know as an LB).

A. Rigid metal conduit (RMC) or intermediate metal conduit (IMC) shall be used for entrance conduits that exceed 50 feet into the building.

B. Horizontal Conduits

1. Support horizontal conduits at intervals not exceeding ten feet and within three feet of each outlet, junction box, backboard, enclosure or cabinet. Support conduits from structural steel members with spring steel type or beam conduit clamps and to non-metallic structural members with one-hole conduit straps. For exposed conduits and where conduits must be suspended below structure, single conduit runs shall be supported from structure by hanger rod and conduit clamp assembly, and multiple conduits shall be supported by trapeze type support suspended from structure. Do not attach conduits to ceiling suspension system channels or suspension wires.
2. For runs that total more than 100 feet in length, insert pull boxes so that no segment between boxes exceeds the 100 feet limit.
3. Each horizontal home-run conduit can serve from one (1) to three (3) outlet boxes. For one (1) outlet box, a 3/4" conduit shall be used, minimum. For two (2) outlet boxes, a 1" conduit shall be used, minimum. For three (3) outlet boxes, a 1-1/4" conduit shall be used, minimum.

3.03 COMMUNICATIONS OUTLET BOXES

A. Exact locations of the outlet boxes shall be coordinated with the electrical contractor and other trades.

B. Non-metallic communications outlet boxes may only be used for wood frame construction and/or where code allows.

C. The approximate locations of the outlets are indicated on the Drawings. The exact locations of outlets shall be determined at the building. The right is reserved to change, without additional cost, the exact location of any outlet, a maximum of 10' before it is permanently installed.

D. Orientation of outlet boxes (horizontal or vertical) shall be as indicated on the architectural elevations.

E. Install all outlet boxes in finished areas flush with the wall. Maintain 1/4" or less space between outlet box front and finished wall surface.

F. Outlet boxes shall be firmly anchored in place and shall not depend on the coverplate to hold it secure to the wall.

G. Outlet boxes installed back-to-back in fire-rated walls shall be separated horizontally by a minimum of 24".

3.04PULL BOXES

A. Pull boxes shall be secured, independent of the conduit entries into the box. Pull boxes shall be secured to the building structure. In ceiling applications, pull boxes shall not be supported with ceiling wires.

B. Conduits entering pull boxes shall connect to pull boxes using die-cast zinc connectors.

C. Pull boxes shall be free from burrs, dirt and debris.

D. Pull boxes shall be installed in accordance with ANSI/TIA-569-B.

E. Pull boxes shall be grounded in accordance with ANSI/TIA-607-B.

3.05CABLE TRAY SYSTEM

A. Install trays in accordance with recognized industry practices, to ensure that the cable tray equipment complies with requirements of the NEC.

B. All open trays shall be installed a minimum of six (6) inches away from any light fixture.

C. Provide external grounding strap at expansion joints, sleeves, crossover and other locations where tray continuity is interrupted.

D. Support all pathways from building construction. Do not support pathways from ductwork, piping or equipment hangers.

E. Install cable tray level and straight.

F. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete cable tray system.

G. Cable trays shall not be used to house both low voltage and power cables unless cables are separated by a grounded physical barrier.

H. Cable tray system shall be grounded in accordance with ANSI/TIA-607-B.

3.06CABLE HANGERS

A. Only use J-hooks to support cables bundles of eight (8) or less. J-hooks shall be wall-mounted.

B. Installation and configuration shall conform to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1 & ANSI/TIA-569-B, NFPA 70 (National Electrical Code), applicable local codes, and to the manufacturer's installation instructions.

C. Install cables using techniques, practices, and methods that are consistent with Category 6 / Category 6A and that supports Category 6 / Category 6A performance of completed and linked signal paths, end to end.

D. Install cables without damaging conductors, shield, or jacket.

E. Do not bend cables, in handling or in installing, to smaller radii than minimums recommended by manufacturer.

F. Pull cables without exceeding cable manufacturer's recommended pulling tensions. Use pulling means that will not damage media.

G. Do not exceed load ratings specified by manufacturer.

H. Adjustable non-continuous support sling shall have a static load limit of 20 lbs.

I. To avoid electromagnetic interference (EMI), pathways shall provide minimum clearances of four feet from motors or transformers, one foot from conduit and cables used for electrical power distribution, and five inches from fluorescent lighting. Pathways shall cross perpendicular to fluorescent lighting and electrical power cables or conduits.

3.07 TIE WRAPS AND VELCRO STRAPS

A. Tie wraps/Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Tie wraps shall secure cables to cable trays using an "X" pattern.

C. Do not over-cinch cables.

3.08 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 05 28
January 23, 2025

SECTION 27 05 43
UNDERGROUND DUCTS AND RACEWAYS FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Underground Ducts and Raceways for Communications Systems.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Rigid/Intermediate Conduit Manufacturer(s)

1. Allied
2. Wheatland

B. PVC/HDPE Conduit Manufacturer(s)

1. Carlon
2. Dura-Line
3. Petroflex

C. Innerduct/Inner-Conduit Channel Manufacturer(s)

1. Carlon
2. Endot Industries
3. MaxCell
4. Petroflex

D. Marker Tape Manufacturer(s)

1. William Frick & Associates

E. Approved Maintenance Hole/Handhole Manufacturer(s)

1. Old Castle
2. Pencell (Handholes Only)
3. Quazite (Handholes Only)

F. Approved Conduit Plug/Cap Manufacturer(s)

1. Jack Moon

2.02 CONDUIT SYSTEM

A. PVC conduit for concrete encasement shall be Type DB, UL Labeled for 90 degrees C cables. Fittings shall be Type DB, solvent type, and from the same manufacturer as the conduit.

B. Concrete shall have a minimum strength of 2,500 psi at 28 days.

C. PVC conduit for direct burial shall be Schedule 40, UL Labeled for 90 degrees C cables. Fittings shall be Schedule 40, solvent type, and from the same manufacturer as the conduit.

D. Rigid and Intermediate Conduit

1. Rigid conduit, intermediate conduit, couplings, locknuts, bushings, elbows and connectors shall be standard thread. All materials shall be steel. Set screw or non-threaded fittings are not permitted.
2. Galvanized rigid steel conduit shall be hot dipped galvanized inside and outside, in 10 foot lengths and threaded on both ends. Fittings and bushings shall be threaded, cast or malleable iron, and hot dipped galvanized inside and outside.

E. Non-Metallic Conduit

1. Non-metallic conduit shall be heavy wall, Schedule 40 PVC / HDPE.
2. Couplings and connectors for non-metallic conduit shall be of the same material and be the product of the same manufacturer of the conduit furnished.

F. Conduit Support

1. Conduit straps shall be single-hole cast metal type or two hole galvanized metal type. Conduit clamps shall be spring steel type for use with exposed structural steel.

G. Innerduct/Inner-Conduit Channel

1. Innerduct shall be non-corrugated PVC equipped with mule tape.
2. Inner-conduit channel (MaxCell) shall be 3-channel with each channel equipped with mule tape.
3. See Drawings for innerduct/inner-conduit channel (MaxCell) details.

H. Marker Tape

1. Marker tape shall be detectable, orange for communications, and labeled to indicate the type of circuit buried below.

2.03 MAINTENANCE HOLES/HANDHOLES

A. Maintenance Holes

1. Maintenance holes shall be pre-cast or cast in place concrete with a strength of 3,500 psi at 28 days, and steel reinforced.
2. Maintenance holes shall include a cast iron frame with cover, a hot dipped galvanized steel ladder, and hot dipped galvanized pulling eyes embedded in the concrete opposite each duct entrance and in the floor beneath the cover.
3. Maintenance holes shall be equipped with grounding busbar.
4. Maintenance holes shall be equipped with racking for cable storage.
5. Ground splices and connections at maintenance holes shall be exothermic welds, copper or bronze compression ground fittings, or bolted compression ring lugs.
6. The cover for maintenance holes shall have the lettering, “COMMUNICATIONS.”

B. Handholes

1. Handholes shall be non-conductive and shall not require grounding for safety. Handholes shall be unaffected by freeze/thaw and resistant to sunlight and chemicals. Handholes shall be pre-cast polymer concrete, heavy duty rated and bottomless.
2. Handholes shall be equipped with racking for cable storage.
3. Handholes shall have the word “COMMUNICATIONS” molded in the cover by the manufacturer. The cover shall be attached with penta-head stainless steel bolts.
4. Handholes shall be able to withstand 10,000 lbs minimum.
5. See Drawings for handhole dimensions and locations.

2.04 CONDUIT PLUGS/CAPS

A. Conduit Plugs/Caps

1. Conduit plugs shall provide a watertight seal at expose ends of conduits.
2. Conduit plugs shall be conduit size specific.
3. Triplex and Quadplex duct plugs shall provide a watertight seal between the conduit and innerduct(s).
4. Simplex duct plugs shall provide a watertight seal between the innerduct and the cable that occupies it.
5. TDUX inflatable bladders shall be used to seal conduits equipped with MaxCell.

PART 3 - EXECUTION

3.01 CONDUIT SYSTEM

A. Excavation and Backfill

1. Contractor shall call underground utilities locator company before digging.
2. Barricades shall be provided around open holes and trenches. Temporary bridges shall be provided over trenches cut through major sidewalk routes. Major sidewalk routes shall not be closed to pedestrian traffic.
3. Barriers shall be provided to protect landscaping adjacent to the excavation area.
4. When rocks, concrete or other debris are encountered during excavation, remove completely.
5. Where sidewalk sections must be removed for installation of underground ducts, remove the sidewalk sections completely from joint to joint.
6. Where asphalt must be removed for installation of underground ducts, saw cut the asphalt in two, straight, parallel lines.
7. Backfill excavations in 6-inch layers and mechanically compact to 98 percent compaction.
8. Excavated materials may be used as backfill only if the backfill is sand or clean dirt that is free of rocks and debris over 3/4" in diameter.

9. In landscaped areas, backfill and mechanically compact to a depth of 6 inches below grade.
10. Backfill the last 6 inches with clean topsoil. Reseed lawn areas.
11. Restore concrete sidewalks and asphalt.
12. The Contractor shall perform all excavation to install the electrical work herein specified and as indicated on Drawings. During excavation, material for backfilling shall be piled back from the banks of the trench to avoid overloading and to prevent slides and cave-ins. All excavated materials not to be used for backfill shall be removed and disposed of by the Contractor. Grading shall be done to prevent surface water from flowing into trenches and others excavation and any water accumulating therein shall be removed by pumping. All excavation shall be made by open cut.
13. The bottom of the trenches shall be graded to provide uniform bearing and support for conduits, cables, or duct bank on undisturbed soil at every point along its entire length. Overdepths shall be backfilled with loose, granular, moist earth, tamped. Remove unstable soil that is not capable of supporting equipment or installation and replace with specified material for a minimum of 12" below invert of equipment or installation.
14. The trenches shall be backfilled with the excavated materials approved for backfilling, consisting of earth, loam, sandy clay, sand and gravel or soft shale, free from large clods of earth and stones, deposited in 6" layers and rammed until the installation has a cover of not less than the adjacent ground but not greater than 2" above existing ground. The backfilling shall be carried on simultaneously on both sides of the trench so that injurious pressures do not occur. The compaction of the filled trench shall be at least equal to 95% of the maximum density as determined by the Standard Proctor Test. Settling the backfill with water will not be permitted. Reopen any trenches not meeting compaction requirements or where settlement occurs, refill, compact, and restore the surface to the grade and compaction indicated, mounded over and smoothed off

B. Duct Banks

1. Duct banks shall be sloped downward toward maintenance holes/handholes and away from buildings a minimum of 6 inches per 100 feet. Duct banks shall not route water from maintenance holes handholes into buildings. Duct banks shall not contain traps between maintenance holes/handholes where water may accumulate.
2. Directional changes in duct banks shall be made with 20' minimum radius bends. Duct banks and direct buried ducts shall be supported on undisturbed soil or on piers extending down to undisturbed soil.
3. Where power and communications duct banks run in parallel, they shall be separated by a minimum of 12 inches.
4. Prior to concrete encasement, ducts, reinforcing steel and ground wires shall be secured with nonmetallic straps or cable ties to nonmetallic duct spacers at intervals not exceeding 8 feet. Duct spacers shall be sized for the ducts being held, and shall provide the minimum spacing between ducts required for concrete flow and by the NEC. Duct spacers shall be anchored to the ground using nonmetallic bands and stakes.
5. Duct banks shall have a minimum of 3 inches of concrete cover on all sides.
6. Where duct banks enter maintenance holes or buildings, they shall be constructed as integral to the wall.
7. Duct bank shall extend to the inside surfaces of the walls, and the duct bank reinforcing shall be integrated with the wall reinforcing.
8. Bell ends shall be provided on ducts where the ducts enter maintenance holes or buildings.
9. Direct buried ducts and fittings shall have bend radii greater than the minimum bend radii of the cables enclosed, and shall not be smaller than the radii of standard manufactured elbows.
10. Direct buried ducts shall be installed parallel to or at right angles to building lines and site features, and as close to curbs and sidewalks as possible to avoid interferences with future landscaping.

11. Where direct buried PVC ducts cannot be buried deep enough to meet the NEC minimum cover requirements, rigid steel conduits shall be installed instead, or a concrete cover shall be poured over the ducts.
12. An orange detectable marker tape (for communications) shall be buried in the backfill approximately 12 inches above duct banks or direct buried cables for the entire length of the duct run.
13. A flexible mandrel and a stiff bristled brush shall be pulled through the ducts to clean them prior to cable pulling.
14. Ducts shall be identified in the maintenance holes and at both ends.

C. Additional OSP Conduit Requirements

1. Leave all empty conduits with a 200-pound test nylon cord pull line.
2. Install a #14 AWG tracer wire in one conduit for the entire length of each duct run.
3. Flattened, dented, or deformed conduits are not permitted and shall be removed and replaced.
4. Install conduit, including homeruns as indicated on the Drawings. Any change resulting in a savings in labor or materials is to be made only in accordance with a contract change. Deviations shall be made only where necessary to avoid interferences and when approved by Engineer by written authorization.
5. Where conduits must pass through structural members obtain approval of Architect.
6. Install all conduits or sleeves penetrating or routed within rated firewalls or fire floors to maintain fire rating of wall or floor. Conduit shall not be installed in rated floors or walls if it compromises or violates the fire rating of floor or wall. Refer to architectural documents.
7. Provide expansion and deflection coupling where conduit passes over a building expansion joint.
8. Service entrance conduits and feeder conduits in direct contact with earth shall be schedule 40, heavy wall PVC/HDPE. All service entrance conduit elbows shall be galvanized rigid steel. Service entrance conduits installed exposed or concealed in walls or above ceilings shall be galvanized rigid steel (GRS) or intermediate metal conduit (IMC). Service entrance conduits shall be installed “outside” of the building as defined by the N.E.C. Provide concrete encasement where required or as indicated on Drawings.
9. Seal all conduits entering building to prevent entrance of moisture.
10. Conduit fittings shall be gland and ring compression type for all conduit exposed to outdoor environments.
11. Below Grade Conduit Installations
    a. Install top of conduits 24 inches minimum below finished grade or as indicated on Drawings.
    b. Install top of conduits 6 inches minimum below bottom of building slabs.
    c. Where transition is made from below grade PVC installation to a metallic conduit system above grade or slab.
12. Communications cables shall not occupy conduits with power cables.
13. All metallic conduits shall be grounded in accordance with ANSI/TIA-607-B.
14. For runs that total more than 400 feet in length, insert handholes/maintenance holes so that no segment exceeds the 400 feet limit.
15. Conduit runs shall not have more than two (2) 90-degree bends between pull points.
16. Communication conduit system shall contain no condulets (also known as an LB).

3.02 MAINTENANCE HOLES/HANDHOLES

A. Maintenance holes/handholes shall be installed on a base of pea gravel at least 12 inches deep.

B. Tops of maintenance holes/handholes shall be level with the existing grade.

C. Ducts should enter as perpendicular to the wall surface as possible.

D. Maintenance holes shall be grounded with four 3/4 inch diameter by 8 foot long ground rods, one driven inside of the maintenance hole at each corner. Connect the ground rods and any duct bank ground conductors together with a No. 4/0 AWG bare, stranded copper ground wire loop. A No. 2 AWG bare stranded copper pigtail from the ground wire loop shall be used to ground the maintenance hole cover frame, ladder support bracket, any metallic concrete inserts and metallic cable racks, and the shields of any cables that are spliced in the maintenance hole.

3.03 CONDUIT PLUGS/CAPS

A. Protect conduits against dirt, plaster, and foreign debris with conduit plugs. Plugs shall remain in place until ready for use.

B. Simplex, triplex or quadplex duct plugs shall be installed in conduits to house and seal cables.

C. TDUX inflatable bladders shall be used to seal conduits equipped with MaxCell.

3.04 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 25 43
January 23, 2025

SECTION 27 05 53
IDENTIFICATION FOR COMMUNICATIONS SYSTEMS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Identification for Communications Systems.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required materials whether specifically addressed in the Specification or not.

PART 2 - LABELING

2.01 LABELING REQUIREMENTS

A. Labeling shall be done in accordance with the recommendations made in the ANSI/TIA-606-A document, manufacturer's recommendations and best industry practices.

B. All spaces, pathways, outlets, cables, termination hardware, grounding system and equipment shall be labeled with machine-generated labels.

C. All labels shall be clear with black text.

D. All cables shall be labeled with machine generated, wrap around labels.

E. A total of three (3) labels per horizontal cable are required at the following intervals: 6" from outlet; 18" from outlet' 12" from termination block/patch panel.

F. Labeling scheme shall be alphanumeric.

END OF SECTION 27 05 53
January 16, 2025

SECTION 27 08 00
COMMISSIONING OF COMMUNICATIONS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the equipment and execution requirements relating to Commissioning of Communications.

C. Equipment specifications, general considerations, and guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - TESTING

2.01 TESTING REQUIREMENTS

A. General

1. All cables and termination hardware shall be 100% tested for defects in installation and to verify cabling system performance under installed conditions according to the requirements of ANSI/TIA-568-C.0, ANSI/TIA-568-C.1, and/or ANSI/TIA-1152. All conductors/strands of each installed cable shall be verified prior to system acceptance. Any defect in the cabling system installation including but not limited to cable, connectors, feed through couplers, patch panels, and connector blocks shall be repaired or replaced in order to ensure 100% useable conductors/strands in all cables installed.

B. Copper Testing

1. All twisted-pair copper cable links shall be tested for continuity, pair reversals, shorts, opens and performance as indicated below. Additional testing is required to verify Category 6 performance. Horizontal balanced twisted pair cabling shall be tested using a level IIe, III, and/or IV test unit for category 6 performance compliance.
2. Continuity - Each pair of each installed cable shall be tested using a test unit that shows opens, shorts, polarity and pair-reversals, crossed pairs and split pairs. The test shall be recorded as pass/fail as indicated by the test unit and referenced to the appropriate cable identification number and circuit or pair number. Any faults in the wiring shall be corrected and the cable re-tested prior to final acceptance.
3. Length - Each installed cable link shall be tested for installed length using a TDR type device. The cables shall be tested from patch panel to patch panel, block to block, patch panel to outlet or block to outlet as appropriate. The cable length shall conform to the maximum distances set forth in the ANSI/TIA-568-C.2 Standard. Cable lengths shall be recorded, referencing the cable identification number and circuit or pair number. For multi-pair cables, the shortest pair length shall be recorded as the length for the cable.
4. Approved tester is as follows:

Fluke DTX

C. Fiber Testing

1. All fiber testing shall be performed on all fibers in the completed end-to-end system. There shall be no splices unless clearly defined in the RFP and/or Drawings. These tests also include continuity checking of each fiber.
2. Singlemode
   a. Test the optical fiber cable bi-directionally with an OTDR and uni-directionally with a power meter/light source. Fiber must be tested at both 1310nm and 1550nm. Maximum attenuation at 1310 nm shall be 0.5 dB/Km. Maximum attenuation at 1550 nm shall be 0.5 dB/Km. Maximum attenuation per connector pair shall be 0.75 dB. Maximum attenuation per splice shall be 0.3 dB. Attenuation testing shall be performed with a stable launch condition using one-meter or two-meter jumpers to attach the test equipment to the cable plant. The light source shall be left in place after calibration and the power meter moved to the far end to take measurements. Test set-up and performance shall be conducted in accordance with ANSI/TIA-568-C.3, and to the manufacturer's application guides.

3. Approved optical fiber test equipment manufacturers are as follows:
   a. Power Meters & Light Sources
      Fluke
      Optical Wavelength Laboratories (OWL)
      Noyes
      Photonix
   b. Optical Time Domain Reflectometers (OTDR)
      Fluke
      Nettest
      Anritsu
      Tektronix

D. Coaxial Testing

1. Sweep testing of each reel of coaxial cable shall be performed over the 5 MHz through 1 GHz range by the cable manufacturer for transmission and structural return loss and be so certified in writing by the cable manufacturer.
2. Verification testing with a verification field test instrument will determine shorts, continuity, termination location and length of cable.
3. Approved testers are as follows:
   Fluke DTX

E. Test Results

1. Test documentation shall be provided electronically on disk or USB drive as part of the as-built package. The disk/drive shall be clearly marked on the outside front cover with the words “Project Test Documentation,” the project name, and the date of completion (month and year). The results shall include a record of test frequencies, cable type, conductor pair (or strand) and cable (or outlet) I.D., measurement direction, reference setup, and crew member name(s). The test equipment name, manufacturer, model number, serial number, software version and last calibration date will also be provided at the end of the document. Unless the manufacturer specifies a more frequent calibration cycle, an annual calibration cycle is anticipated on all test equipment used for this installation. The test document shall detail the test method used and the specific settings of the equipment during the test as well as the software version being used in the field test equipment.

2. The field test equipment shall meet the requirements of ANSI/TIA-568-C.2, ANSI/TIA-568-C.3, and/or ANSI/TIA-1152.
3. Printouts generated for each cable by the wire (or fiber) test instrument shall be submitted as part of the documentation package. The Contractor shall also furnish this information in electronic format. The format must be readable from Microsoft Word.
4. When repairs and re-tests are performed, the problem found and corrective action taken shall be noted, and both the failed and passed test data shall be documented.

PART 3 - DOCUMENTATION, AS-BUILTS, TRAINING AND RECORDS

3.01 DOCUMENTATION & AS-BUILTS

A. As-Built record documentation for communications work shall include:

1. Cable routing and identification
2. System function diagrams
3. Manufacturers' description literature for equipment
4. Connection and programming schedules as appropriate
5. Equipment material list including quantities
6. Spare parts list with quantities
7. Details not on original Contract Documents
8. Test results
9. Warranties
10. Release of liens

B. The Contractor shall provide and maintain at the site a set of prints on which shall be accurately shown the actual installation of all work under this section, indicating any variation from contract drawings, including changes in pathways, sizes, locations and dimensions. All changes shall be clearly and completely indicated as the work progresses.

C. Progress prints shall be available for inspection by the Owner or any of his representatives and may be used to determine the progress of communications infrastructure work.

D. At the completion of the work, prepare a new set of as-built drawings, of the work as actually noted on the marked-up prints, including the dimensioned location of all pathways.

E. Furnish as-built drawings and documentation to the Owner. As-built drawings shall be generated in AutoCad 2024 or later. Submit as-built drawings electronically.

3.02 OPERATIONS AND MAINTENANCE MANUAL

A. After completion of the work, the Contractor shall furnish and deliver to the Engineer three (3) copies of a complete Operations & Maintenance Manual. A system wiring diagram shall be furnished for each separate system.

B. The manual shall be subdivided into separate sections with tab dividers to identify subsystems of the integrated system. Reference appropriate Specification sections.

C. Provide the following additional information for each electronic system. Information shall be edited for this project where applicable.

1. Operations manuals for components and for systems as a whole
2. Maintenance manuals for components and for system as a whole
3. Point-to-point diagrams, cabling diagrams, construction details and cabling labeling details

4. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
5. Emergency instructions for operational and maintenance requirements
6. Delivery time frame for replacement of component parts from suppliers
7. Recommended inspection schedule and procedures for components and for system as a whole
8. List of spare parts, materials and suppliers of components. Provide name, address and telephone number for each supplier.
9. Complete “reviewed” shop drawings and product data for components and system as a whole
10. Troubleshooting procedures for each system and for each major system component

3.03 TRAINING

A. The Contractor shall be responsible for training of facility personnel. Training shall take place after occupancy and before acceptance and shall include programs for on-site operations and maintenance of technology and communications systems. Training shall be for not more than ten (10) people, shall be held at the Owner's site and shall be of sufficient duration and depth to ensure that the trained personnel can operate the installed systems and can perform usual and customary maintenance actions.

3.04 WARRANTY

A. General

1. All equipment is to be new and warranted free of faulty workmanship and damage.
2. Replacement of defective equipment and materials and repair of faulty workmanship within 24 hours of notification, except emergency conditions (system failures), which must be placed back in service within eight (8) hours of notification, all at no cost to the Owner.
3. The minimum warranty provisions specified shall not diminish the terms of individual equipment manufacturer's warranties.

B. Voice & Data Structured Cabling

1. Contractor shall provide a Leviton LIMITED LIFETIME WARRANTY for components used in the installed Voice & Data Structured Cabling System. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

C. Coaxial Cabling Infrastructure

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Coaxial Cabling Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

D. Pathway & Support Infrastructure

1. Manufacturer(s) shall provide a minimum 1-year warranty for components used in the installed Pathway & Support Infrastructure. Defective and/or improperly installed products shall be replaced and/or correctly installed at no cost to the Owner.

END OF SECTION 270800
January 23, 2025

SECTION 27 11 13
COMMUNICATIONS ENTRANCE PROTECTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Entrance Protection.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Building Entrance Protector Terminal Manufacturer(s)

1. Circa
2. Tii Technologies - Porta Systems

B. Approved Bonding Shield Connector Manufacturer(s)

1. 3M

2.02 BUILDING ENTRANCE PROTECTOR TERMINALS

A. Indoor Building Entrance Protector Terminal

1. The indoor building entrance protector terminal shall be equipped with 110-connector inputs and outputs and shall accommodate industry standard 5-pin protection modules.
2. The indoor building entrance protector terminal shall protect up to 100-pairs and shall be equipped with an internal fuse link.
3. The indoor building entrance protector terminal shall be wall or frame mountable, and able to be stacked for future expansion.
4. The indoor building entrance protector terminal shall be equipped with external ground connectors that accept 6-14 AWG ground wire.

B. Solid State Surge Protection Modules

1. The solid-state surge protector module shall be 5-pin and shall provide transient and power fault protection for standard telephone line applications.
2. The solid-state surge protector module shall be designed to provide a balanced configuration to protect against line-to-line metallic surges.
3. The solid-state surge protector module shall feature an external failsafe mechanism, which permanently grounds module under sustained high current conditions.
4. The solid-state surge protector module shall feature nanosecond response time and safe mode operation in adverse situations.
5. The solid-state surge protector module shall be UL & cUL Listed.

2.03 BONDING SHIELD CONNECTOR

A. Shield Connector

1. The purpose of the bonding shield connector is to make a stable, low resistant electrical connection between the shield of a communications cable and a ground conductor.
2. The bonding shield connector shall be tin-plated tempered brass.

PART 3 - EXECUTION

3.01 BUILDING ENTRANCE PROTECTOR TERMINALS

A. All copper circuits shall be provided with protection between each building with an entrance cable protector panel. All building-to-building circuits shall be routed through this protector. The protector shall be connected with a minimum #6 AWG copper bonding conductor between the protector ground lug and the telecommunications room (TR) busbar.

B. Building entrance protector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-B Telecommunications Bonding and Ground Standard.

C. Building entrance protector panels shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.02 BONDING SHIELD CONNECTOR

A. Bonding shield connector shall be installed in accordance with the recommendations contained in the ANSI/TIA-607-B Standard.

B. Bonding shield connector shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 13
January 23, 2025

SECTION 27 11 16
COMMUNICATIONS CABINETS, RACKS AND ENCLOSURES

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cabinets, Racks and Enclosures.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Equipment Rack/Cabinet Manufacturer(s)

1. Eaton / B-Line

2.02 EQUIPMENT RACKS/CABINETS

A. Equipment Racks

1. The equipment rack shall be constructed of high strength, lightweight aluminum.
2. The vertical rails of the equipment rack shall be equipped with the EIA hole pattern.
3. 2-Post Rack shall be: 45U H x 20.3" W x 15" D, floor mounted.
4. 4-Post Rack shall be: 45U H x 19" W x 36" D, floor mounted.
5. Wall Mount Rack shall be: 29.2" H x 19" W x 25" D (hinged).
6. Rack color shall be black

B. Equipment Cabinets

1. The frame of the equipment cabinet shall be constructed of high strength steel.
2. Front and rear doors of the equipment cabinet shall be lockable.
3. The vertical rails of the equipment cabinet shall be equipped with the EIA hole pattern.
4. 42U Cabinet shall be: 80" H x 23.6" W x 43.31" D, floor mounted.
5. Wall Mount Cabinet shall be: 12U H x 24.7" W x 25" D.
6. Cabinet color shall be black.

2.03 BACKBOARDS

A. Backboards shall be 3/4" void free plywood. Size of backboard shall be 4' x 8' unless noted differently on Drawings. Backboards shall be painted with two (2) coats of gray fire-retardant paint.

PART 3 - EXECUTION

3.02 EQUIPMENT RACKS/CABINETS

A. Equipment racks shall be securely attached to the concrete floor using minimum 3/8" hardware or as required by local codes.

B. Equipment cabinets shall be installed as per the requirements specified by the manufacturer's installation guidelines.

C. Equipment racks/cabinets shall be placed with a minimum of 40-inch clearance from the walls from the front and rear of the rack or as indicated on Drawings.

D. All equipment racks/cabinets shall be grounded to the telecommunications ground bus bar.

E. Mounting screws not used for installing patch panels and other hardware shall be bagged and left with the rack upon completion of the installation.

F. Contractor shall provide one (1) 25-count bag of rack screws per rack for the Owner. These screws are in addition to what will be used by the contractor to mount the equipment that they are contracted to install.

3.03 BACKBOARDS

A. Install backboards level and secure with hardware that is sufficient to support the load of the backboard and the equipment that will mounted on it. Also, make provisions for future equipment when calculating load weight.

3.04 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 16
January 23, 2025

SECTION 27 11 19
COMMUNICATIONS PATCH PANELS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Termination Blocks and Patch Panels.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Patch Panel Manufacturer(s)

1. Leviton
   a. Empty Patch Panels
      i. 24-Port 1RU #49255-H24
      ii. 48-Port 2RU #49255-H48
   b. Category Jacks
      i. Cat 6 Jack #61110-R*6
      ii. Cat 6A Jack #6110G-R*6
      * color option

B. Approved Optical Fiber Enclosure Manufacturer(s)

1. Leviton
   a. Rack Mount Enclosures
      i. 1RU with Sliding Tray #5R1UM-S03
      ii. 2RU with Sliding Tray #5R2UM-S06
      iii. 3RU #5R3UM-F12
      iv. 4RU #5R4UM-F15
   b. Wall Mount Enclosures
      i. Mini #5WMNT-01C
      ii. Small #5WSML-02C

iii. Medium #5WMED-04C
iv. Large #5WLRG-12C

c. Fiber Clamps
i. Single Fiber Clamp #5RCMP-KIT
ii. Multi-Fiber Clamp #5RCMP-KT2

d. Adapter Plates
i. 12-Fiber LC OM3 Adapter #5F100-2QL
ii. 24-Fiber LC OM3 Adapter #5F100-4QL
iii. 12-Fiber LC OS2 Adapter #5F100-2LL
iv. 12-Fiber LC/APC OS2 Adapter #5F100-2VL
v. 24-Fiber LC OS2 Adapter #5F100-4LL
vi. 12-Fiber SC OM3 Adapter #5F100-2QC
vii. 12-Fiber SC OS2 Adapter #5F100-2LC
viii. 12-Fiber SC/APC OS2 Adapter #5F100-2VC
ix. Blank Panel #5F100-PLT

2.02 PATCH PANELS

A. Modular Patch Panel

1. The modular patch panel shall be compatible with 19" equipment racks, cabinets or wall mount brackets.
2. The modular patch panel shall be equipped with 8-position modular jacks and shall allow for termination using both T568A and T568B wiring schemes.
3. The modular patch panel shall be equipped with front labeling space to facilitate port identification.

B. Modular Jacks

1. Category 6, 8-Position, 8-Contact (8P8C) Modular Jack
a. The connector module shall meet or exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.
b. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
c. The connector module shall be available in both the T568A and T568B wiring configurations within the same module.
d. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
e. Jack colors shall be:
Gray for voice
Blue for data

2.03 OPTICAL FIBER PANELS/ENCLOSURES

A. Rack Mount Optical Fiber Panel/Enclosure

1. The rack mount optical fiber panel/enclosure shall be equipped with either a swing out mechanism or a sliding drawer to access fibers.
2. The rack mount optical fiber panel/enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cable.
3. The rack mount optical fiber panel/enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.

4. The panel/enclosure shall meet or exceed the performance criteria per ANSI/TIA-568-C.3.
5. The rack mount optical fiber panel/enclosure shall be equipped with optical fiber adapter panels.
   a. The optical fiber adapter panels shall be compatible with LC connectors.
   b. Multimode OM3 laser optimized adaptors shall be aqua in color and equipped with zirconia ceramic sleeves.
   c. Singlemode OS2 adaptors shall be blue (UPC) or green (APC) in color and equipped with zirconia ceramic sleeves.

B. Wall Mount Optical Fiber Panel/Enclosure

1. The wall mount optical fiber panel/enclosure shall have a hinged door for access, with locking available for security.
2. The wall mount optical fiber panel/enclosure shall be capable of terminating tight-buffered or loose tube optical fiber cables and all popular connector types.
3. The wall mount optical fiber panel/enclosure shall provide for bend radius control throughout the panel as well as storage space for slack cabling.
4. The panel/enclosure shall meet or exceed the performance criteria per ANSI/TIA-568-C.3.
5. The wall mount optical fiber panel/enclosure shall be equipped with optical fiber adapter panels.
   a. The optical fiber adapter panels shall be compatible with LC or SC connectors.
   b. Singlemode OS2 adaptors shall be blue or green in color and equipped with zirconia ceramic sleeves.

PART 3 - EXECUTION

3.01 PATCH PANELS

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practice.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Bend radius of the cable in the termination area shall not exceed 4 times the outside diameter of the cable.

D. Cables shall be neatly bundled and dressed to their respective patch panel. Each patch panel shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

E. Each cable shall be clearly labeled on the cable jacket behind the patch panel at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02 OPTICAL FIBER PANELS/ENCLOSURES

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.

B. Each cable shall be individually attached to the respective splice enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

C. Bend radius of the optic fiber cable in the panel/enclosure shall not exceed 10 times the outside diameter of the cable.

D. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

E. Each cable shall be clearly labeled at the entrance to the splice enclosure. Cables labeled within the bundle shall not be acceptable.

F. A maximum of 12 strands of fiber shall be spliced in each tray

G. All spare strands shall be installed into spare splice trays.

H. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 19
January 23, 2025

SECTION 27 11 23

COMMUNICATIONS CABLE MANAGEMENT AND LADDER RACK

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Cable Management and Ladder Rack.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Horizontal Cable Management Manufacturer(s)

1. Leviton
   a. Front Only
      i. 1RU #491RU-HFO
      ii. 2RU #492RU-HFO
   b. Front & Rear
      i. 1RU #491RU-HFR
      ii. 2RU #492RU-HFR

B. Approved Vertical Cable Management Manufacturer(s)

1. Leviton
   a. Front Only
      i. 5" W #4980L-VFO
      ii. 8" W #8980L-VFO
   b. Front & Rear
      i. 5" W #4980L-VFR
      ii. 8" W #8980L-VFR

C. Approved Ladder Rack System Manufacturer(s)

1. Eaton / B-Line

D. Approved Tie Wrap/Velcro Strap Manufacturer(s)

1. Leviton

E. Approved C-Ring/D-ring Manufacturer(s)

1. Eaton / B-Line

2.02 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal Cable Management

1. The horizontal wire manager shall be compatible with 19-inch equipment racks, cabinets or wall mount brackets.
2. The horizontal cable manager shall provide support for patch cords at the front of the panel.
3. The horizontal cable manager shall be 2 rack-units in height when matched with a 2 rack-unit patch panel or switch.
4. The horizontal cable manager shall be 1 rack-unit in height when matched with a 1 rack-unit patch panel or switch.

2.03 CABLE MANAGEMENT - VERTICAL

A. Vertical Cable Management

1. The vertical cable manger shall be double-sided.
2. The vertical cable manager shall provide support for patch cords at the front of the rack and wire management at the rear of the rack.
3. The vertical cable manager shall be a minimum width of 5".
4. Vertical cable manager color shall be black.

2.04 LADDER RACKS

A. Ladder Rack System

1. See Drawings for ladder rack system details.
2. The ladder rack system shall be securely mounted with hardware designed for use in ladder rack systems.
3. End caps shall be installed on the exposed ends of the ladder racks, channel supports and bolts. Protective covers shall be installed on threaded rods that come in contact with cabling plant.
4. Ladder Rack System color shall be black.

2.05 TIE WRAPS AND VELCRO STRAPS

A. Tie Wraps and Velcro Straps

1. Backbone cables shall be fastened to support structures with tie wraps/Velcro straps.
2. Horizontal cables shall be fastened to support structures with Velcro straps.
   a. Tie Wrap color shall be black.
   b. Velcro Strap color shall be black.

2.06 C-RINGS/D-Rings

A. C-Rings/D-rings

1. C-rings/D-rings shall be used on backboards to support cables, patch cords and cross-connect wire.
2. C-rings/D-rings shall be made of high-strength, fire-retardant material with rounded edges to prevent damage to cable and wire insulation.

PART 3 - EXECUTION

3.01 CABLE MANAGEMENT - HORIZONTAL

A. Horizontal cable managers shall be installed below patch panels in a 1:1 ratio (one horizontal cable manager per patch panel) or as indicated on Drawings.

3.02 CABLE MANAGEMENT - VERTICAL

A. Vertical cable managers shall be installed on both sides of a single equipment rack. Where two (2) or more racks are positioned in a row, vertical cable managers shall be installed between each rack and each end of the row.

3.03 LADDER RACKS

A. Ladder rack system shall be installed straight, level and perpendicular to walls and ceiling slabs.

B. Ladder racks shall be supported at 5' intervals maximum.

C. Provide all hardware, accessories, fasteners, anchors, threaded rods and support channels required to provide a complete ladder rack system.

D. See Drawings for ladder rack system details.

3.04 TIE WRAPS AND VELCRO STRAPS

A. Tie wraps/Velcro straps shall be installed around cables at intervals of 12" minimum.

B. Tie wraps shall secure cables to ladder racks using an “X” pattern.

C. Do not over-cinch cables.

3.05 C-RINGS/D-RINGS

A. C-ring/D-rings shall be installed on 3/4" backboard, straight and level.

3.06 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 23
January 23, 2025

SECTION 27 11 26
COMMUNICATIONS RACK MOUNTED POWER DISTRIBUTION

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Rack Mounted Power Distribution.

C. Product Specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Power Distribution Unit Manufacturer(s)

1. Leviton
2. Eaton

2.02 POWER DISTRIBUTION UNITS

A. Power Distribution Unit

1. The power distribution unit shall be equipped with a minimum of twelve (12) 3-prong, 120 VAC outlets, and 12' cord.
2. The power distribution unit shall be equipped with surge protection with a 20 Amp current limit.
3. The power distribution unit shall be equipped with a bracket that enables it to be mounted on a 19" rack, cabinet or wall mount bracket without modification.

PART 3 - EXECUTION

3.01 POWER DISTRIBUTION UNITS

A. Power distribution units shall be installed as per the requirements specified by the manufacturer's installation guidelines.

B. See Drawings for installation location on rack(s)/cabinet(s).

3.02 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 11 26
January 23, 2025

SECTION 27 13 23

COMMUNICATIONS OPTICAL FIBER BACKBONE CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Optical Fiber Backbone Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Optical Fiber Backbone Cable (Inside Plant) Manufacturer(s)

1. Berk-Tek
   a. Premise Distribution Plenum Cable (PDP)
   b. Premise Distribution Riser Cable (PDR)

B. Approved Optical Fiber Backbone Cable (Outside Plant) Manufacturer(s)

1. Berk-Tek
   a. Riser Adventum (LTR)

C. Approved Optical Fiber Connectivity Manufacturer(s)

1. Leviton
   a. Pre-Polished
      i. OM3 LC #49991-LLC
      ii. OM3 SC #49991-LSC
      iii. OS2 LC #49991-SLC
      iv. OS2 SC #49991-SSC
      v. OS2 SC/APC #49991-ASC
   b. Epoxy Cured
      i. OS2 LC 2/3 mm Boot #49990-SL2

ii. OS2 LC 900 micron Boot #49990-SDL
iii. OS2 SC #49991-SSC

D. Approved Splice Case Manufacturer(s)

1. 3M

2.02 OPTICAL FIBER BACKBONE CABLE (INSIDE PLANT)

A. Plenum - Indoor Distribution 8.3/125-micron Singlemode Optical Fiber Non Conductive (OFNP) Tight Buffered Cable

1. Generic Characteristics
   a. The indoor optical fiber cable shall be available with up to twelve 900-micron tight-buffered, 250-micron fibers placed in a color-coded sub-unit bundle with aramid strength elements.
   b. The indoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
   c. The indoor optical fiber cable shall have sequential length markings printed on the cable jacket.
   d. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.
   e. The loss of fiber shall not exceed 1.0 dB per kilometer @ 1550 nm and 1.0 dB per kilometer @ 1310 nm.

B. Riser - Indoor 8.3/125-micron, Singlemode Optical Fiber Non Conductive (OFNR) Loose Tube cable

1. Generic Characteristics
   a. The indoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking gel.
   b. The indoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
   c. The indoor optical fiber cable shall have sequential length markings printed on the cable jacket.
   d. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber panel or wall-mounted enclosure.
   e. The loss of fiber shall not exceed 0.50 dB per kilometer @ 1550 nm and 0.50 dB per kilometer @ 1310 nm.

2.03 OPTICAL FIBER BACKBONE CABLE (OUTSIDE PLANT)

A. Indoor/outdoor 8.3/125-micron, Singlemode Optical Fiber Non Conductive (OFNR) Loose Tube cable

1. Generic Characteristics
   a. The indoor/outdoor optical fiber cable with up to twelve 250-micron coated fibers placed in a color-coded sub-unit bundle with moisture-blocking gel.
   b. The indoor/outdoor optical fiber cable shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
   c. The indoor/outdoor optical fiber cable shall have sequential length markings printed on the cable jacket.
   d. All singlemode fibers shall be pigtail spliced into a rack mounted optical fiber enclosure or wall-mounted enclosure.

e. The loss of fiber shall not exceed 0.50 dB per kilometer @ 1550 nm and 0.50 dB per kilometer @ 1310 nm.

2.04 OPTICAL FIBER CONNECTORS

A. Singlemode Fiber Connectivity

1. The optical fiber field-installable connector shall be LC or SC, for installation onto singlemode 8.3/125-micron fiber.
2. The optical fiber field-installable connector shall meet or exceed the performance criteria found in ANSI/TIA-568-C.3.
3. The optical fiber field-installable connector shall be compatible with 2 mm, 3mm or 900-micron buffered fibers or 250-micron loose-tube fibers.
4. The preferred method of terminating loose-tube singlemode fiber is pigtail splicing into a rack mounted optical fiber panel or wall-mounted enclosure. Pigtails shall be factory terminated and 3 meters in length. A fiber enclosure with slack storage trays must be used when pigtail-splicing method is used.
5. The splice loss through each connector pair shall not exceed 0.50 dB.
6. The optical fiber adapter module that occupies the faceplate shall be equipped with zirconia ceramic sleeve.
7. Singlemode fiber connector color shall be blue.

2.05 SPLICE CASES

A. Canister Splice Case

1. Splice cases shall be water tight and designed for outside plant applications.
2. All splice trays, seals and hardware shall be from the same manufacturer as the splice case.
3. Splice trays shall utilize heat-shrink seals.
4. See Drawings for size requirements.

PART 3 - EXECUTION

3.01 BACKBONE CABLES (INSIDE PLANT)

A. Cables shall be dressed and terminated in accordance with the recommendations made in ANSI/TIA-568-C.0 and/or ANSI/TIA-568-C.1, manufacturer's recommendations and best industry practices.

B. Backbone cables shall be installed separately from horizontal distribution cables

C. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

D. Where cables are housed in conduits, the backbone and horizontal cables shall be installed in separate conduits

E. Exposed cables must be OFNP rated if installed in an air return plenum. Riser rated cables shall be installed in metallic conduit if installed in an air return plenum.

F. Where backbone cables and distribution cables are installed in a cable tray or wireway, backbone cables shall be installed first and bundled separately from the horizontal distribution cables.

G. Leave 10' of slack on each end of fiber backbone cable.

H. Backbone cables spanning more than three floors shall be securely attached at the top of the cable run with a wire mesh grip and on alternating floors or as required by local codes.

I. Vertical runs of cable shall be supported to messenger strand, cable ladder, or other method to provide proper support for the weight of the cable.

J. Large bundles of cables and/or heavy cables shall be attached using metal clamps and/or metal banding to support the cables.

K. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

L. Each optical fiber cable shall be individually attached to the respective enclosure by mechanical means. The cables strength member shall be securely attached the cable strain relief bracket in the enclosure.

M. Each optical fiber cable shall be clearly labeled at the entrance to the enclosure. Cables labeled within the bundle shall not be acceptable.

N. Each fiber bundle shall be stripped upon entering the splice tray and the individual fibers routed in the splice tray.

O. A maximum of 12 strands of fiber shall be spliced in each tray

P. All spare fiber strands shall be installed into spare splice trays.

Q. Fiber slack shall be neatly coiled within the fiber splice tray or enclosure. No slack loops shall be allowed external to the fiber panel.

3.02BACKBONE CABLES (OUTSIDE PLANT)

A. All OSP cables brought to the Entrance Facilities shall have 15 ft of slack coiled and secured to the wall in the proximity of the fiber enclosure.

B. All cables shall be tagged and identified within each handhole/maintenance hole.

C. Place initial cables in bottom conduits to facilitate easy subsequent cable placement.

D. Place leader guard in the duct before placing cable to prevent damaging the cable sheath on the sharp edge of the duct.

E. Ventilate maintenance where gas has been detected before entering the maintenance hole.

F. To ensure that the optical fiber cable's qualities and characteristics are not degraded during installation, excessive pulling tensions and short bending radii will not be allowed. The maximum pulling tension is 600 lbs. The minimum bending radius for cable under tension is 20 times the outside diameter of the cable and for cable at rest is 10 times the outside diameter of the cable.

G. A 600 lb. break-away swivel, along with a slip clutch capstan winch that shows the dynamometer (pulling tension) reading, shall be used at all times during pulling.

H. At each splice location the cable ends will be sealed watertight at all times. Reels will be continuously manned during cable installation.

I. Contractor shall coil 60 feet of spare optical fiber cable in each handhole/maintenance hole without a splice and 75 feet of each optical fiber cable in each handhole/maintenance hole with a splice. Cable coils shall have at least two points of support on the optical fiber racking system.

J. When mounting the optical fiber slack coils, the minimum bend radius shall not be exceeded; this radius is equal to 10 times the outside diameter of the cable in a static application and 20 times the outside diameter in a dynamic application. At anytime during the entire handling process of the optical fiber cable, as much care as possible should be maintained and all the manufacturer's recommendations should be followed.

3.03 OPTICAL FIBER CONNECTIVITY / SPLICING

A. Optical fiber connectors shall be installed as per the requirements specified by the manufacturer's installation guidelines.

B. All splicing shall be of the fusion type made under Light Injection and Detection Mode, whenever applicable. The Contractor shall provide certified and experienced personnel for splicing.

C. Contractor's tools and equipment shall be in excellent working order. Any worn or improperly working tools shall be discarded and not used on this project. All fusion splicers shall be calibrated and labeled according to the manufacturer's specifications. Contractor shall submit certification of calibration for the fusion splicers to the Engineer.

3.04 SPLICE CASES

A. Splice Cases shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.05 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 13 23
January 23, 2025

SECTION 27 15 13
COMMUNICATIONS COPPER HORIZONTAL CABLING

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Copper Horizontal Cabling.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer’s specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Horizontal Copper Cable Manufacturer(s)

1. Category 6
   a. Berk-Tek – LANmark 1000

2.02 HORIZONTAL COPPER CABLE

A. 100 OHM Category 6 Balanced Twisted Pair Cable

1. The horizontal balanced twisted pair cable shall EXCEED the Category 6 transmission characteristics per issue of ANSI/TIA-568-C.2.
2. Cable jacket shall be CMR or CMP rated (according to the space it occupies).
3. Jacket color shall be:
   a. Gray for voice.
   b. Blue for data

PART 3 - EXECUTION

3.01 HORIZONTAL CABLES

A. Cable shall be installed in accordance with manufacturer's recommendations and best industry practices.

B. A plastic or nylon pull cord with a minimum test rating of 90 Kg (200 lb.) shall be co-installed with all cable installed in any conduit.

C. Cable raceways shall not be filled greater than the ANSI/TIA-569-B maximum fill for the particular raceway type.

D. Cables shall be installed in continuous lengths from origin to destination (no splices) except for transition points, or consolidation points.

E. Riser rated cable shall be installed in metallic conduit when installed in a plenum space.

F. Where transition points or consolidation points are allowed, they shall be located in accessible locations and housed in an enclosure intended and suitable for the purpose.

G. The cable's minimum bend radius and maximum pulling tension shall not be exceeded. Refer to manufacturer's requirements.

H. If a J-hook or trapeze system is used to support cable bundles all horizontal cables shall be supported at a maximum of 48 to 60 inch (1.2 to 1.5 meter) intervals. At no point shall cable(s) rest on acoustic ceiling grids or panels.

I. Horizontal distribution cables shall be bundled in groups of no more than 50 cables. Cable bundle quantities in excess of 50 cables may cause deformation of the bottom cables within the bundle and degrade cable performance.

J. Cable shall be installed above fire-sprinkler systems and shall not be attached to the system or any ancillary equipment or hardware. The cable system and support hardware shall be installed so that it does not obscure any valves, fire alarm conduit, boxes, or other control devices.

K. Cables shall not be attached to ceiling grid or lighting fixture wires. Where support for horizontal cable is required, the Contractor shall install appropriate carriers to support the cabling.

L. Any cable damaged or exceeding recommended installation parameters during installation shall be replaced by the Contractor prior to final acceptance at no cost to the Owner.

M. Cables shall be dressed and terminated in accordance with the recommendations made in the ANSI/TIA-568-C.2 document, manufacturer's recommendations and best industry practices.

N. Leave a minimum of 12" of slack for twisted pair cables at the outlet. Cables shall be coiled in the in-wall box, surface-mount box or modular furniture raceway if adequate space is present to house the cable coil without exceeding the manufacturers bend radius. In hollow-wall installations where box-eliminators are used, excess wire can be stored in the wall. Excess slack shall be loosely coiled and stored in the ceiling above each drop location when there is not enough space present in the outlet box to store slack cable.

O. Cables shall be neatly bundled and dressed to their respective termination device. Each terminating device shall be fed by an individual bundle separated and dressed back to the point of cable entrance into the rack or frame.

P. Each cable shall be clearly labeled on the cable jacket behind the termination device at a location that can be viewed without removing the bundle support ties. Cables labeled within the bundle, where the label is obscured from view shall not be acceptable.

3.02IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 15 13 – January 23, 2025

SECTION 27 15 43
COMMUNICATIONS FACEPLATES AND CONNECTORS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Faceplates and Connectors.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this Specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

1.04 DEFINITIONS

A. Commercial Products – to be used in common areas, offices, restaurants, retail and parking garages.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Commercial Copper Connectivity Manufacturer(s)

1. Leviton
   a. Category Jacks
      i. Cat 6 Jack #61110-R*6
         * color option

B. Approved Commercial Coaxial Connectivity Manufacturer(s)

1. Leviton
   a. Nickel-Plated Modules
      i. #41084-F*F
         * color option
2. Gilbert
   a. Compression Connectors

C. Approved Commercial Faceplate Manufacturer(s)

1. Leviton
   a. Plastic QuickPort Single-Gang with ID Windows
      i. 1-Port #42080-1*S
      ii. 2-Port #42080-2*S
      iii. 3-Port #42080-3*S
      iv. 4-Port #42080-4*S
      v. 6-Port #42080-6*S
      * color option
   b. Stainless Steel QuickPort Single-Gang with ID Windows
      i. 1-Port #43080-1L1
      ii. 2-Port #43080-1L2
      iii. 3-Port #43080-1L3
      iv. 4-Port #43080-1L4
      v. 6-Port #43080-1L6
   c. Plastic QuickPort Dual-Gang with ID Windows
      i. 1-Port #42080-1*P
      ii. 2-Port #42080-2*P
      iii. 3-Port #42080-3*P
      iv. 4-Port #42080-4*P
      v. 6-Port #42080-6*P
      vi. 8-Port #42080-8*P
      vii. 12-Port #42080-12*
      * color option
   d. Stainless Steel QuickPort Dual-Gang with ID Windows
      i. 2-Port #43080-2L2
      ii. 4-Port #43080-2L4
      iii. 6-Port #43080-2L6
      iv. 8-Port #43080-2L8
      v. 12-Port #43080-L12

D. Approved Residential Faceplate Manufacturer(s)

1. Leviton
   a. Plastic Midsize Single-Gang
      i. 1-Port #41091-1*N
      ii. 2-Port #41091-2*N
      iii. 3-Port #41091-3*N
      iv. 4-Port #41091-4*N
      v. 6-Port #41091-6*N
      * color option

E. Approved Surface Mount Box manufacturer(s)

1. Leviton
   a. QuickPort Surface Mount Box
      i. 1-Port #41089-1*P
      ii. 2-Port #41089-2*P
      iii. 4-Port #41089-4*P
      iv. 6-Port #41089-6*P
      v. 12-Port #41089-12*
      * color option

2.02 COPPER CONNECTIVITY

A. Voice/Data Jacks

1. Category 6, 8-Position, 8-Contact (8P8C) Modular Jack
   a. The connector module shall meet or exceed the Category 6 performance criteria per ANSI/TIA-568-C.2.
   b. The eight-position connector module shall accommodate six-position modular plug modular cords without damage to either the cord or the module.
   c. The connector module shall be available in both the T568A and T568B wiring configurations within the same module.
   d. The connector module shall have an insulation displacement connection featuring insulation slicing of 22 to 24 AWG plastic-insulated solid copper conductors forming a gas-tight connection.
   e. Jack colors shall be:
      Gray for voice
      Blue for data

2.03 COAXIAL CONNECTIVITY

A. Connectors shall be solderless, 75-Ohm impedance and be designed for the specific type of cable used.

B. Series-6 connectors shall be one piece. Series-11 connectors shall use the cable's center conductor as the connector's center pin.

C. All Series-6 and Series-11 connections shall be made with compression-type connectors.

D. Screw-on connectors are not acceptable.

E. The coaxial adapter module that occupies the faceplate shall be a 75-ohm, F-type connector.

2.04 FACEPLATES

A. Commercial Faceplates

1. The faceplate housing the connector modules shall have no visible mounting screws.
2. It shall be possible to install the connector modules in wall-mounted single- and dual-gang electrical boxes, utility poles and modular furniture (cubicle) access points using manufacturer-supplied faceplates and/or adapters.
3. The faceplate housing the connector modules shall have the option of being mounted on adapter boxes for surface mount installation.
4. The faceplate housing the connector modules shall have a labeling capability using built-in labeling windows, to facilitate outlet identification and ease network management.
5. The faceplate housing the connector modules shall provide flexibility in configuring multimedia workstation outlets that respond to present or future network needs such as audio, video, coaxial and optical fiber applications.
6. Color shall be same as electrical faceplates.

2.05 SURFACE MOUNT BOXES

A. The surface mount box shall accommodate connections of any type, UTP, optical fiber or coax.

B. The surface mount box shall have internal storage space for slack cabling and a built-in spool for controlling cable bend radius.

C. Color shall be same as electrical faceplates.

PART 3 - EXECUTION

3.01 COPPER CONNECTIVITY

A. 8-position, 8-contact (8P8C) modular jacks shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. Pair untwist at the termination shall not exceed 13 mm (0.5 inch).

C. Data jacks, unless otherwise noted in Drawings or fiber adapter modules are present, shall be located in the bottom position(s) of each faceplate. Data jacks in horizontally oriented faceplates shall occupy the right-most position(s).

D. Voice jacks, unless otherwise noted in Drawings, shall occupy the top position(s) on the faceplate. Voice jacks in horizontally oriented faceplates shall occupy the left-most position(s).

3.02 COAXIAL CONNECTIVITY

A. F-connectors shall be installed in accordance with manufacturer's recommendations and installation guides, and best industry practices.

B. Cable preparation and connector application shall be done only with tools approved for use with the connector.

3.03 FACEPLATES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized through out the installation.

C. Faceplates shall be installed straight and level.

D. Faceplates shall be installed at the same heights as electrical faceplates.

3.04 SURFACE MOUNT BOXES

A. Blank inserts shall be installed where ports are not used.

B. The same orientation and positioning of jacks and connectors shall be utilized through out the installation.

C. Surface mount boxes shall be installed straight and level.

D. Surface mount shall be installed at heights as electrical receptacles.

3.05 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 15 43
January 23, 2025

SECTION 27 16 19
COMMUNICATIONS PATCH CORDS

PART 1 - GENERAL

1.01 GENERAL REQUIREMENTS

A. Applicable requirements of Division 27 - Communications shall be considered a part of this section and shall have the same force as if printed herein full.

B. This document describes the products and execution requirements relating to Communications Patch Cords.

C. Product specifications, general design considerations, and installation guidelines are provided in this document. The successful vendor shall meet or exceed all requirements described in this document and on the drawings.

1.02 SUBMITTALS

A. Provide product data from manufacturer's specifications.

1.03 WORK INCLUDED

A. The work included under this specification consists of furnishing all labor, equipment, materials, supplies and performing all operations necessary to complete the installation. The Contractor will provide and install all of the required material whether specifically addressed in the Specification or not.

PART 2 - PRODUCTS

2.01 APPROVED PRODUCTS

A. Approved Copper Patch Cord Manufacturer(s)

1. Leviton
   a. Cat 6
      i. 3' #6D460-03*
      ii. 5' #6D460-05*
      iii. 7' #6D460-07*
      iv. 10' #6D460-10*
      * color option

B. Approved Fiber Patch Cord Manufacturer(s)

1. Leviton
   a. Singlemode OS2 LC/LC Duplex Fiber Patch Cord
      i. 1m # FPC-S2RD1RR-001MAB
      ii. 2m # FPC-S2RD1RR-002MAB
      iii. 3m # FPC-S2RD1RR-003MAB
   b. Singlemode OS2 LC/APC to LC/APC Duplex Fiber Patch Cord
      i. 1m # FPC-S2RR1VV-001MAB
      ii. 2m # FPC-S2RR1VV-002MAB
      iii. 3m # FPC-S2RR1VV-003MAB
   c. Singlemode OS2 SC/SC Duplex Fiber Patch Cord
      i. 1m # FPC-S2RD1QQ-001MAB

ii. 2m # FPC-S2RD1QQ-002MAB
iii. 3m # FPC-S2RD1QQ-003MAB

d. Singlemode OS2 SC/APC to SC/APC Duplex Fiber Patch Cord
i. 1m # FPC-S2RD1EE-001MAB
ii. 2m # FPC-S2RD1EE-002MAB
iii. 3m # FPC-S2RD1EE-003MAB

2.02 COPPER PATCH CORDS

A. Category 6 Patch Cords

1. The Category 6 patch cord shall be 4-pair, with 24 AWG solid or stranded copper conductors and 8-position modular plug.
2. The Category 6 modular cord cable shall be UL Listed as Type CMR.
3. The Category 6 patch cord shall meet or exceed the requirements of ANSI/TIA-568-C.2.
4. Lengths shall be 3', 5', 7' and/or 10' as required by the application.
a. The Category 6 patch cord color for data shall be: Blue

2.03 FIBER PATCH CORDS

A. Singlemode Fiber Patch Cords

1. 8.3/125-micron singlemode fiber patch cord:
a. The 8.3/125-micron fiber used in the singlemode fiber patch cord shall have a maximum attenuation of 1.0 dB/km @ 1310 nm and 1.0 dB/km @ 1550 nm.
b. The optical fiber cord connector shall have a maximum insertion loss of 0.5 dB and a reflectance of -30 dB.
c. The 8.3/125-micron singlemode fiber patch cord shall meet or exceed the requirements of ANSI/TIA-568-C.3.
d. The optical fiber cord connector shall be LC.
e. The singlemode fiber patch cord assembly shall be dual zip jacketed.
f. Lengths shall be 1m, 2m, and/or 3m as required by the application.
g. Angle polish connectors shall be used for video distribution.

PART 3 - EXECUTION

3.01 COPPER PATCH CORDS

A. Copper patch cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.02 FIBER PATCH CORDS

A. Fiber patch cords shall be installed as per the requirements specified by the manufacturer's installation guidelines.

3.03 IDENTIFICATION

A. Refer to Section 27 05 53 - Identification for Communications Systems for labeling details.

END OF SECTION 27 16 19
January 23, 2025

SECTION 280300
IP VIDEO SURVEILLANCE SYSTEM

PART 1 - GENERAL

1.01 SUMMARY.

A. Provide IP Video Equipment as specified herein and as shown on the schedules and drawings. Installing contractor shall receive, place, connect, and mount all equipment specified in this Section per the manufacturer's instructions. Installing contractor shall furnish all hardware, wire, connectors, and other necessary items as required for a complete and functional IP Video System.

B. Related Sections:
   1. Section 11190 Detention Equipment
   2. Section 260000 Electrical
   3. Section 280000 Security Electronics, General
   4. Section 280110 Graphic Control Panels
   5. Section 280120 Touch Screen System
   6. Section 280140 Programmable Logic Controller
   7. Section 280200 Intercommunications System

1.02 REFERENCES.

A. The General Conditions, Supplementary Conditions, and Division 1 Specifications shall apply to all work of this section.

B. Standards listed by reference, including revisions by issuing authority, form a part of this specification section to extent indicated. Standards listed are identified by issuing authority, authority abbreviation, designation number, title, or other designation established by issuing authority. Standards subsequently referenced herein are referred to by issuing authority abbreviation and standard designation.

C. Underwriter's Laboratories (UL)
   1. UL 508 Industrial Control Equipment
   2. NEC National Electrical Code (latest edition)

D. Network – IEEE
   1. 802.3 Ethernet Standards
   2. 802.1x Port-based Network Access Control

E. Video
   1. ISO / IEC 14496–10, MPEG-4 Part 10 (ITU H.264)
   2. ISO / IEC 10918 – JPEG
   3. ONVIF – Profiles S G and T

F. Federal Communications Commission (FCC):
   1. FCC Rules and Regulation of Title 47 of CFR Part 15 Subpart B Class A.

1.03 WORK INCLUDED

A. Included under this Section of the work shall be the furnishing, installation, connection, aiming and testing of the complete IP Video System including, but not limited to, cameras, microphones, housings, mounts, cables, monitors, network switches, network video recorders and storage equipment, and fiber optic systems.
B. Major Sub-systems include:
   1. Programmable Logic Controllers (PLC's).
   2. Touch Screen Control Stations.
C. The lenses provided for cameras shall be changed as required, at no cost, to provide the Owner with an acceptable field of view.

1.04 APPROVALS

A. General
   1. Submittals shall be made in accordance with the General Provisions (Section 280000) of these specifications.
B. Specific Requirements:
   1. Submit catalog cuts for all equipment and devices being furnished under this Section.
   2. Submit a complete IP Video System riser diagram. Diagram shall include labeling of each camera and its corresponding head end equipment input, interconnecting wiring of all components including but not limited to digital controllers, digital video recorders, camera power supplies, monitors, control keyboards, and PLC interface connections.
   3. Submit plan drawings showing location, mounting and viewing angle of each camera.

1.05 DESCRIPTION

A. The IP Video System shall monitor spaces as shown on the drawings and function as shown on the IP Video System functional schematic.
B. All cameras shall be recorded, and video storage shall be sized to retain recordings for all video for a duration of 30 days. All cameras shall be recorded at their native resolution at a rate of 15 images per second. Recording shall be calculated for a minimum of 70% motion. Servers shall have RAID 6 storage arrays.
C. A VMS integration method shall be furnished and installed to provide auto select and manual selection of video cameras. Auto-select shall be initiated by acknowledging intercom call-in requests or by inputs from the Touch Screen or desk mounted video control panels. A manual video selector shall be incorporated into the Touch Screen System to provide for selection of a specific camera to be monitored by an operator. Switching logic for auto selection of video may be a single logic control unit or may represent logic control signals generated from other systems such as the intercom system or door locking control system.
D. Video Switching/Control:
   1. Some Control Stations are equipped with two intercom call-up monitors for movement control. These are designated as shown on the drawings. The first monitor (ex. M1) shall view the side of the door from which the intercom call was initiated. The second monitor (ex. M2) shall view the opposite side of the door. Cameras on both sides of a door will be called up and display simultaneously upon acknowledging an intercom

call. If a door has only one camera viewing it, the monitor displaying the side without a camera shall be blank. Activating an intercom by touching the intercom icon on the touch screen shall switch the associated cameras to these intercom call-up monitors. For conditions such as elevator lobbies, monitors shall display lobby video and cab video.

E. The PLC shall be the basis of control for the integrated IP Video System Camera call-up. A communications interface shall be provided between the PLC and the IP Video System.
F. Software Licensing and Warranty:
   1. Software licensing should be on a per device basis (e.g. 1 x license for 1 IP Camera or I/O device) with no base license for additional features or capabilities.
   2. The VMS Software should be completely free for live streaming or playback of offline media files (images, videos).
   3. Desktop Client Software shall be available for download at no additional charge to the owner. There shall be no license fee associated with Desktop Client Software.
   4. Lifetime software upgrades shall be provided by the Manufacturer without cost and without the need for an annual maintenance agreement.

PART 2 - PRODUCTS

2.01 MATERIALS

A. Except as otherwise specified, herein, or in the General Conditions, the equipment and materials of this Section shall be products of the following listed manufacturers, subject to compliance with the specification requirements and provided each manufacturer meets all requirements of the Quality Assurance Section of this specification.
B. Acceptable Manufacturers:
   1. Hanwha-Vision, Teaneck, NJ
   2. Pelco, Fresno, CA
   3. Bosch, Lancaster, PA
C. Hanwha-Vision is used as the basis of design. Comparable equipment from other listed manufacturers may be used if all specified requirements are incorporated.
D. Cameras:
   1. IP Cameras shall be the standard product of one manufacturer complying with not less than the specifications contained herein. Installation of each camera shall include mounting brackets and/or camera housings fully compatible with the camera provided. All interior and exterior cameras shall be equal to the models specified following.
   2. All dome cameras shall be constructed with a metal casing to ensure durability, impact resistance, and enhanced protection against vandalism and environmental conditions. The use of polycarbonate or any non-metallic casings is strictly prohibited. All metal casings must be corrosion-resistant and suitable for both indoor and outdoor applications as required.
   3. 2MP AI IR Exterior Vandal Dome Camera:
      a. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
      b. Tamper-Resistant Hardware

c. Minimum Illumination: Color: 0.01Lux(F1.4, 1/30sec, 30IRE) B/W : 0.001Lux(F1.4, 1/30sec, 30IRE)
d. Motorized Varifocal Lens of 208 mm to 12.0 mm with Auto Iris
e. Angular Field of View - H : 119.5°(Wide)~27.9°(Tele) V : 62.8°(Wide)~15.7°(Tele) D : 142.1°(Wide)~32.0°(Tele)
f. Manual Pan / Tilt / Rotate Range: 0˚~360˚/ -45˚~75˚/ 0˚~355˚
g. Resolution: 2.0 Megapixel (1920 X 1080)
h. IR Viewable Length - 40m(131.23ft)
i. Digital Image Stabilization – built-in gyro sensor
j. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
    1) Day & Night: Auto (ICR)
    2) Wide Dynamic Range: 150dB
k. Privacy Masking: 32ea, quadrangle zones
l. Analytics events based on AI engine (NPU): Object detection (Person/Face/Vehicle - car, truck, bus, bicycle, motorcycle/License plate
m. Object based analytics (AI) shall be inherent to the camera, not VMS dependent and license free.
n. IVA (Virtual line/Area, Enter/Exit, Loitering, Direction, Intrusion)
o. Analytics: Defocus detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line/Directional detection, Audio detection, Sound classification, Shock detection.
p. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
q. H.265/H.264: Maximum 60fps, MJPEG: Maximum 30fps
r. Multiple streaming (Up to 10 profiles, 3 virtual channel support)
s. Shall support ONVIF Profile S/G/T
t. TPM 2.0 (FIPS 140-2 level 2)
u. Edge Storage: Micro SD/SDHC/SDXC 1slot maximum 512GB
v. 12 VDC or POE
w. Certifications: IP66/IP67, IK10, NEMA4X
x. Operating Temperature Range -58° F to 131° F (-40° C to +55° C).
y. Camera shall be XNV-C6083R or approved equal

4. 6MP AI IR Exterior Vandal Dome Camera:
    a. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes
    b. Tamper-Resistant Hardware
    c. Minimum Illumination: Color: 0.04 Lux (F1.3, 1/30sec, 30IRE), 0 Lux (IR LED on)
    d. Motorized Varifocal Lens of 4.4 mm to 9.3 mm with Auto Iris
    e. Angular Field of View - H : 112.1°(Wide)~47.5°(Tele) V : 58.0°(Wide)~26.6°(Tele) D : 137.5°(Wide)~54.6°(Tele)
    f. Manual Pan / Tilt / Rotate Range: 0˚~360˚/ -45˚~85˚/ 0˚~355˚
    g. Resolution: 6.0 Megapixel (3328 X 1872)
    h. IR Viewable Length - 40m(131.23ft)
    i. Digital Image Stabilization – built-in gyro sensor
    j. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)

1) Day & Night: Auto (ICR)
2) Wide Dynamic Range: 120dB

k. Privacy Masking: 32ea, quadrangle zones
l. Analytics events based on AI engine (NPU): Object detection (Person/Face/Vehicle - car, truck, bus, bicycle, motorcycle/License plate
m. Object based analytics (AI) shall be inherent to the camera, not VMS dependent and license free.
n. IVA (Virtual line/Area, Enter/Exit, Loitering, Direction, Intrusion)
o. Analytics: Defocus detection, Fog detection, Face detection, Motion detection, Appear/Disappear, Enter/Exit, Loitering, Tampering, Virtual line/Directional detection, Audio detection, Sound classification, Shock detection.
p. Audio In: Selectable (mic in/line in), Supply voltage: 2.5VDC (4mA), Input impedance: 2K Ohm
q. H.265/H.264: Maximum 30fps, MJPEG: Maximum 15fps
r. Multiple streaming (Up to 10 profiles, 3 virtual channel support)
s. Shall support ONVIF Profile S/G/T
t. TPM 2.0 (FIPS 140-2 level 2)
u. Edge Storage: Micro SD/SDHC/SDXC 1slot maximum 512GB
v. 12 VDC or POE
w. Certifications: IP66/IP67, IK10, NEMA4X
x. Operating Temperature Range -58° F to 131° F (-40° C to +55° C).
y. Camera shall be XNV-C8083R

5. 2x 2MP Dual-Sensor Multi-directional:
   a. The Vandal Resistant Multi-Directional camera shall have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 512 GB) and be enclosed in a cast-aluminum housing with an aluminum trim ring and a clear polycarbonate dome bubble (with UV blocking anti-scratch coating) and a hardened inner liner and be capable of operating in an indoor or an outdoor environment.
   b. The camera shall provide multi directional view and produce video in various view modes.
   c. Motorized Varifocal Lens of 3.0 mm to 6.0 mm with Auto Iris
   d. Video
      1) Video Compression: H.265, H.264, MJPEG, Multiple streaming
      2) Resolution: Dual 1080P (1920x1080) Sensors
      3) Frame Rate: H.265/H.264: Maximum 30fps
      4) Dynamic Range: Wide Dynamic Range, 150dB
      5) Digital Noise Reduction: SSNR
   e. Minimum Illumination: Color: 0.035lux(F2.2, 1/30sec, 30IRE) BW: 0.0035lux(F2.2, 1/30sec, 30IRE), 0lux(IR LED on)
   f. Imager: 1/2.8" 2MP CMOS x 2CH
   g. Optical
      1) Viewing Angle:
         a) H: 107(Wide)~56(Tele)
         b) V: 57(Wide)~31(Tele)

c) D: 126(Wide)~64(Tele)

h. Application Programming Interface: ONVIF Profile S/ T SUNAPI (HTTP API)
i. Mechanical
   1) Dome: Polycarbonate, clear, UV-blocking anti-scratch, IK10 Impact Resistance
   2) Certifications: IP66/IP67, NEMA4X, IK10
   3) Camera Body: Aluminum
   4) Pan / Tilt / Rotate Range: -0˚~355˚/ 0˚~78˚/ 0˚~180˚
j. TPM 2.0(FIPS 140-2 certified)
k. Camera shall be PNM-7082RVD or approved equal

6. 3 x 2MP Triple-Sensor Multi-directional:
   a. The Vandal Resistant Multi-Directional camera shall have a microSD card slot that uses standard; off-the-shelf microSD (SDHC and SDXC) cards for local storage (up to 512 GB) and be enclosed in a cast-aluminum housing with an aluminum trim ring and a clear polycarbonate dome bubble (with UV blocking anti-scratch coating) and a hardened inner liner and be capable of operating in an indoor or an outdoor environment.
   b. The camera shall provide multi directional view and produce video in various view modes.
   c. Motorized Varifocal Lens of 3.0 mm to 6.0 mm with Auto Iris
   d. Video
      1) Video Compression: H.265, H.264, MJPEG, Multiple streaming
      2) Resolution: Dual 1080P (1920x1080) Sensors
      3) Frame Rate: H.265/H.264: Maximum 30fps
      4) Dynamic Range: Wide Dynamic Range, 150dB
      5) Digital Noise Reduction: SSNR
   e. Minimum Illumination: Color: 0.04lux(F2.2, 1/30sec) BW: 0.004lux(F2.2, 1/30sec)
   f. Imager: 1/2.8" 2MP CMOS x 3CH
   g. Optical
      1) Viewing Angle:
         a) H: 107(Wide)~56(Tele)
         b) V: 57(Wide)~31(Tele)
         c) D: 126(Wide)~64(Tele)
   h. Application Programming Interface: ONVIF Profile S/G/T
   i. Mechanical
      1) Dome: Polycarbonate, clear, UV-blocking anti-scratch, IK10 Impact Resistance
      2) Certifications: IP66, IK10, NEMA4X
      3) Camera Body: Aluminum
      4) Pan / Tilt / Rotate Range: -0˚~355˚/ 0˚~73˚/ 0˚~90˚
   j. Camera shall be PNM-8082VT or approved equal
7. Exterior 16 MP Multi Sensor:
   a. Fully Integrated Enclosure with multiple Camera Sensors and Lenses
   b. Rugged, High-Impact and Vandal Resistant, Puncture Proof Domes

c. Tamper-Resistant Hardware
d. Field of View: 360-degree and producing video in quad view mode.
e. Minimum Illumination: Color: 0.075Lux (F1.5, 1/30sec, 30IRE) BW: 0.0075Lux(F1.5, 1/30sec, 30IRE), 0Lux(IR LED on
f. Motorized Varifocal Lens of 3.3 mm to 5.7 mm with Auto Iris
g. Angular Field of View
    1) H: 100˚(Wide) ~ 53˚(Tele)
    2) V: 54˚(Wide) ~ 30˚(Tele)
    3) D: 125˚(Wide) ~ 64˚(Tele)
h. Resolution: 2592x1520, 1920x1080, 1280x1024, 1280x960, 1280x720, 1024x768, 800x600, 800x448, 720x576, 720x480, 640x480, 640x360, 320x240
i. Shall be a true Day/Night camera with Wide Dynamic Range (WDR)
    1) Auto (ICR)
    2) Wide Dynamic Range: 120dB
j. Privacy Masking: 6ea, rectangular zones
k. Intelligent Video Analytics: Classified object type: Person/Face/Vehicle/License plate Attributes: Vehicle (Type: car/bus/truck/motorcycle/bicycle) Support BestShot Analytics events based on AI engine - Object detection, Virtual line(Crossing/Direction), Virtual area(Loitering/Intrusion/Enter/Exit) Analytics events - Defocus detection, Motion detection, Tampering, Audio detection, Sound classification, Virtual area(Appear/Disappear)
l. H.265/H.264: Max. 30fps/25fps(60Hz/50Hz) at all resolutions
m. Streaming: Multicast Multiple streaming (Up to 3 profiles per channel)
n. Shall support ONVIF Profile S/T
o. Edge Storage: Micro SD/SDHC/SDXC 2slot Max. 1TB (512GBx2)
p. Power: PoE+(IEEE802.3at Type2, Class4)
q. Operating Temperature Range -40°F to 131° F (-40°C to 55° C).
r. Certifications: IP66, NEMA4X, IK10
s. Exterior wall mounted locations shall include a compatible wall mount.
t. Camera shall be PNM-C16083RVQ or approved equal

8. Ceiling Mounted Security Microphone
    a. Microphone type – Electret Condenser
    b. Output - Line Level (0dB @1KΩ), unbalanced
    c. Frequency response - 40 Hz to 15 kHz ± 1 dB
    d. Current drain - 4 mA
    e. Supply voltage - 12Vdc, 500mA
    f. Dimensions - 4"dia x 1 ½"H
    g. Sturdy ABS housing
    h. Microphone shall be Louroe Verifact “A”

E. All camera installations shall be securely attached to mounting surface. Use lead shields on solid masonry, toggle bolts for hollow masonry, and machine bolts for steel. All anchoring devices shall be rated to support not less than five times the total equipment weight.
F. Video Surveillance Monitors:

1. Video Surveillance Monitors shall be the standard products of one manufacturer and compatible with the total system specified, herein, and complying with these specifications. Monitors and cameras shall be provided by the same manufacturer.
2. Surveillance Monitors shall be LED flat panel type as indicated on the drawings and as specified herein. All monitors shall be U.L. listed.
3. Twenty-Four (24) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 1920 x 1200
   b. Panel Aspect Ratio 16:10
   c. Pixel Pitch 0.270 x 0.270mm
   d. Contrast Ratio 1000:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 4 ms
4. Thirty-Two (32) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 2560 x 1440
   b. Panel Aspect Ratio 16:9
   c. Pixel Pitch 0.276 x 0.276mm
   d. Contrast Ratio 3000:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 5 ms
5. Fourty-Three (43) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 3840 x 2160
   b. Panel Aspect Ratio 16:9
   c. Pixel Pitch 0.276 x 0.276mm
   d. Contrast Ratio 4,700:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 8 ms
6. Fifty (50) inch monitors shall be mounted as shown on the drawings. Monitors shall comply with not less than the following specifications:
   a. LED Panel Resolution: 3840 x 2160
   b. Panel Aspect Ratio 16:9
   c. Pixel Pitch 0.276 x 0.276mm
   d. Contrast Ratio 4,700:1
   e. Viewing Angle (H/V) 178°/178°
   f. Response Time 8 ms

G. Client Workstations:
   1. Remote monitoring environment for video and audio over the network.
   2. Unit shall be able to display any camera on any monitor over the network.
   3. Incorporates graphic map features to depict camera locations.
   4. General Properties:
      a. Camera search and Discovery:
         1) Capable of searching Network Video Recorders for connected cameras.
         2) Cameras are Searched or Discovered:

a) Camera will be automatically viewed and current camera information (fps, days of recording) displayed.

b. Support up to four monitor outputs.
c. Recording and Playback Functions:
    1) Simultaneous playback capability up to 128 video channels of resolutions of (4 cif to 12 MPS).
    2) Compression Support: CoH.265, H.264, and MJPEG.
    3) View AAC, PCM, g726, and MPS audio.
    4) Set recording schedules.
    5) Set up triggered recording based on:
        a) Sensor (input) detection.
        b) Camera event, analytics based in Wisenet Cameras.
        c) Motion detection.
        d) Video loss detection.
    6) Available recording settings that can be set up or changed by channel for standard and event-based recording types:
        a) Compression type.
        b) Resolution.
        c) Images per second.
        d) Quality.
        e) Data transfer limit.
        f) Pre-event and post-event record duration.
        g) I-frame and full frame recording.
    7) Search recorded data by time, event trigger, motion alarms, events
d. Storage: 1x 256GBSSD.
    1) USB connection for export device for video clip backup and settings export.
e. Live View:
    1) Remote monitoring.
    2) Streams: H.265, H.264, MJPEG.
    3) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
    4) Configure and exercise functions for connected PTZ cameras, including functionality with compatible USB joystick.
    5) Capture and save snapshot images.
f. Up to Four High Definition local monitor outputs live viewing, playback, and backup functions.
g. ONVIF Profile S compliance.

5. System:
    a. Processor: Intel® Core™ i3-9100 3.6Ghz to 4.2Ghz (4Cores, 4Threads, 6MB).
    b. Memory: 8 GB DDR4.
    c. Operating Systems: Windows 10 Professional.
    d. USB Ports: Rear: (2) USB 3.1 Gen 1, (2) USB 2.0; Front: (2) USB 3.1 Gen 1, (2) USB 2.0.
    e. Video Output: 3x Mini DisplayPort with 2x HDMI adapters.

f. Wi-Fi: IEEE 802.11ac.
g. Other Ports: 1x PS2, 2x Wi-Fi Antennas, 3.5 mm audio in/out, 1x SPDIF out.
h. Keyboard and Mouse: Included.

6. Video Compression: H.265, H.264, and MJPEG.
7. Events and Response Actions:
   a. Triggers:
      1) Motion.
      2) Video loss.
      3) Event defined by camera.
   b. Response Actions:
      1) Record.
      2) E-mail.
      3) Activate PTZ preset.
      4) Event trigger program.
      5) Sound output.
8. Playback:
   a. Number of simultaneous channels: Not limited.
9. Network:
   a. Connectivity: 1000 Base-T Ethernet, 2 x RJ-45 connectors.
   b. Protocols Supported:
      1) Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP).
      2) Configuration: Dynamic Host Configuration Protocol (DHCP).
      3) Web Services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS).
      4) Network Services: Address Resolution Protocol (ARP), Domain Name System (DNS), Internet Control Message Protocol (ICMP), Network Time Protocol (NTP), Simple Network Management Protocol (SNMP v1/2c/3 - MIB-2), Universal Plug and Play (UPnP).
      5) Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol, Real-Time Streaming Protocol (RTSP).
      6) Multicast: Internet Group Management Protocol (IGMP).
      7) Notifications: Simple Mail Transfer Protocol (SMTP).
      8) Remote Access: Point-to-Point Protocol over Ethernet (PPPoE).
   c. Security Features:
      1) User password protection with group restrictions.
      2) User access log.
10. Audio:
    a. Direction: Bi-directional.
    b. Compression: AAC (16/48 KHz), G.711 u-law, G.726 selectable.
    c. Output: Line level (RCA).
11. Electrical:
    a. Power: 100 to 240 VAC.
    b. Power Supply: 250 W.
12. Environmental:

a. Mouse and Keyboard: Included.
b. Temperature; Operating and Storage: 32 to 122 degrees F (0 to 50 degrees C).
c. Humidity: 5 to 85 percent, RH non-condensing.

H. Rackmount Servers:
1. Network Video Recorder ("NVR"):
a. Record Video and Audio: 470 Mbps
b. Send data from video cameras to a hard disk array of 1 to 12 HDDs within a rack mountable format and enable playback of video and audio from the hard disk array.
1) Pre-configured with the VMS.
2) Remote monitoring environment for video and audio over network using a remote computer.
c. General Properties:
1) Camera Search and Discovery: Search network for connected compatible cameras via Onvif Profile S or the manufacturer's native driver.
a) Cameras are Searched or Discovered:
(1) Cameras automatically registered and current camera information (fps, days of recording) displayed.
(2) Ability to selectively register as many as cameras can be found.
2) Support dual monitor out.
3) Support server backup if multiple servers are in the hive for failover for redundancy.
4) Recording and Playback Functions:
a) Support recording 128 dual streams (256 streams) from 352 x 288 (CIF) up to 4000 X 3000 (12 MP) per channel.
b) 470 Mbps network camera recording throughput.
c) Simultaneous Playback Capability: 128 video channels.
d) Compression Support: H.265, H.264, and MJPEG.
e) NVR to record and stream AAC, PCM, g726, and MPS audio.
f) View status of internal connected storage hardware.
g) Set recording schedules.
h) Set up triggered recording based on:
(1) Sensor (input) detection.
(2) Camera event, analytics based in the manufacturer's cameras.
(3) Motion Detection.
(4) Video loss detection.
i) Available recording settings by channel for standard and event-based recording types:
(1) Compression type.
(2) Resolution.
(3) Images per second.
(4) Quality.
(5) Data transfer limit.
(6) Pre-event and post-event record duration.
(7) I-frame and full frame recording.

j) Available actions upon reaching full HDD storage capacity:
(1) Stop recording.
(2) Overwrite.
k) Search recorded data by time, event trigger, motion alarms, events.

5) Storage:
a) JBOD configuration for a maximum of 96 TB.
b) RAID Support: RAID 0/1/5/6/10/50/60 plus BBU (backup battery unit).
c) USB connection for memory/storage device for video clip backup and settings export.

6) Live View:
a) Remote monitoring using the manufacturer's supplied viewer.
b) Streams: H.265, H.264, MJPEG.
c) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
d) Configure and exercise functions for connected PTZ cameras, including functionality with compatible USB joystick.
e) Capture and save snapshot images.
f) Record current video in AVI format.

7) Remote Access:
a) Multicast or Unicast: Simultaneous access is unlimited.
b) Mobile Device:
(1) Supported Platforms:
(a) Android.
(b) IOS.
(2) Supported Remote Users: Unlimited amount either live or playback.
(3) Dynamic DNS (DDNS) support.

8) VGA and High Definition (HDMI) local monitor outputs live viewing, playback, and backup functions.
9) ONVIF Profile S compliance.
10) Alarm Connections: None on server. Use of I/O software module to support I/O control.

d. System:
1) Processor: Intel Core i5-7500 3.4 GHz.
2) Memory: 8 GB DDR4
3) Operating Systems: Windows 10 IoT Enterprise.
4) USB Ports: 6x USB 3.0 (rear), 2x USB 3.0 (front).
5) Video Output: 1x Display Port (rear), 1x HDMI (rear), 1x DVI (rear).
6) Other ports: 3.5 mm audio in/out, 1x SPDIF out.
7) Keyboard and Mouse: Included.
8) Sliding Rail Kit: Included.

e. Video Compression: H.265, H.264, MJPEG.

f. Recording:
1) Channel Capability: No limit but recommended to use the manufacturer's

storage Calculator.
2) Bit Rate: 470 Mbps.
3) Resolution Range: 352 x 288 to 4000 X 3000.

g. Events and Response Actions:
1) Triggers:
a) Motion.
b) Video loss.
c) Event defined by camera.
2) Response Actions:
a) Record.
b) E-mail.
c) Activate PTZ preset.
d) Event Trigger program.
e) Sound output.

h. Playback:
1) Number of simultaneous channels: Not limited.
2) Bandwidth: 470 Mbps.

i. OS Drive: OS Drive Bays: 1 to 256 GB SSD internally mounted.

j. Storage:
1) Internal:
a) Number of HDDs Bays: 1 to 12 Bays.
b) Capacity per HDD: 1 to 8 TB.
c) RAID 0/1/5/6/10/50/60 plus BBU (backup battery unit).
2) External Types: USB HDD/Flash drive for backup of video clips, firmware update, settings backup/restore, log export.

k. Network:
1) Connectivity: 1000 Base-T Ethernet, 2 x RJ-45 connectors.
2) Protocols Supported:
a) Transmission Control Protocol (TCP), Internet Protocol (IP) v4 and v6, User Datagram Protocol (UDP).
b) Configuration: Dynamic Host Configuration Protocol (DHCP).
c) Web Services: Hypertext Transfer Protocol (HTTP), Secure HTTP (HTTPS).
d) Network Services: Address Resolution Protocol (ARP), Domain Name System (DNS), Internet Control Message Protocol (ICMP): Network Time Protocol (NTP), Simple Network Management Protocol (SNMP v1/2c/3 - MIB-2), Universal Plug and Play (UPnP).
e) Media: Real-Time Transport Protocol (RTP), Real-Time Control Protocol, Real-Time Streaming Protocol (RTSP).
f) Multicast: Internet Group Management Protocol (IGMP).
g) Notifications: Simple Mail Transfer Protocol (SMTP).
h) Remote Access: Point-to-Point Protocol over Ethernet (PPPoE).
3) DDNS: Support DDNS services offered by the Manufacturer and other publicly available service offerings.
4) Security Features:

a) User password protection with group restrictions.
b) IP address filtering, list of allowed or blocked IP addresses.
c) HTTPS(SSL) login authentication.
d) User access log.
e) 802.1x authentication.
f) Restriction of network access/web viewer access.

5) Discovery: Manufacturer shall offer a discovery program to identify all devices of his manufacture on the network, as well as ONVIF Profile S conformant devices.

l. Alarm/Sensor Interface:
1) Input (0): NO or NC, selectable.
2) Output (0): NO or NC, selectable.
3) Use of I/O software module to support I/O control.

m. Audio:
1) Direction: Bi-directional.
2) Compression: AAC (16/48 KHz), G.711 u-law, G.726 selectable.
3) Output: Line level (RCA).
4) Output: Line level (RCA).

n. Electrical:
1) Power:100 to 240 VAC.
2) Power Supply: 800 W Redundant.

o. Mechanical and Environmental:
1) Color: Black / metal.
2) Front Bezel and lock.
3) Form Factor 2U Rack Mount Chassis. Sliding rails included.
4) Mouse and Keyboard: Included.
5) Dimensions (W x H x D): 17.2 x 3.5 x 26 inch (438 x 87.0 x 660 mm).
6) Weight: 30.86 lbs. (14 kg).
7) Temperature; Operating and Storage: 32 to 122 degrees F (0 to 50 degrees C).
8) Humidity: 5 to 85 percent, RH non-condensing.

2.02 VIDEO MANAGEMENT SYSTEMS (VMS)

A. Video Management Systems: For remote devices and sensors.
1. Software: Wisenet Wave v5.1 as manufactured by Hanwha Vision America.
2. System Requirements:
a. Open video platform designed for use in any video application.
b. Specified Software: To include, free of charge, any API or SDKs necessary to integrate third party devices and systems.
c. Shall include a UART Bridge that will allow serial protocol communications to interface to HMI Software platforms. Interface shall allow the automatic call-up of cameras to tiles within designated monitors for functions such as Intercom Station video follow audio, alarm conditions and spot monitor camera call-up from Touch Screen Icons.
d. Specified Video Management Solution's Architecture: To include Desktop, Media Server, as well as the capability of Mobile, and Cloud applications.

3. Software Components Characteristics: Four applications working seamlessly together.
   a. Cloud Application (if required): Enables simple remote connectivity, viewing, and management of an unlimited number of systems and users.
   b. Media Server Application: Responsible for discovering, connecting to, and managing system users, devices, and associated data.
   c. Desktop Application: Capable of acting as a stand-alone media player or as a client application for connecting to and managing systems.
   d. Mobile Application (if required): For iOS and Android devices that allows users to connect to, view, search, and control IP cameras over Wifi or Data networks.
4. Built-In Developer and Integration Tools: Accessible from System Server's Web Admin Interface (compatible with all major browsers).
   a. Generic Events Generator: Tool which builds HTTP Generic Event calls; a method of sending events from third party systems to the VMS, which can be used to trigger system actions in the VMS.
   b. Server API: SUNAPI implementation giving developers the ability to access every system feature available.
   c. API Change Log: List of breaking changes in API from version to version.
   d. Video Source Integration SDK: Integrate virtually any live or recorded video source (IP Cameras, NVRs, DVRs, etc.) into the VMS with methods for discovering, displaying, analyzing and recording video, as well as integrating device I/O ports and related motion detection information.
   e. Storage SDK: Integrate potential storage into System. Allow developers to read from or write to any storage location; local, remote, or cloud-based (if required). Require implementing standard functions such as: I/O stream, if file exists, delete file, list of files in the folder, etc. Capable of using an FTP server as a storage location.
5. System Architecture:
   a. Server Hive Architecture:
      1) System servers are equal synchronizing system databases in real-time.
      2) Users can connect to any system server to see and manage entire system.
      3) Servers support automatic camera failover ensuring limited loss of video recording in event of hardware or network failure.
      4) Servers use SQLite included in installation package.
   b. One-click System Wide Updates:
      1) System Administrators Capabilities:
         a) Upgrade entire system via single button in Desktop Application.
         b) Upgrade on demand to latest release or specific builds with specific functionality or bug fixes.
         c) Apply an OTA (over-the-air) update.
         d) Generate a URL to download a portable system-specific update package in ' Zip' file format which can be used to update servers without an active Internet connection.
   c. Use secure technologies for inter-application communication and security.
      1) OpenSSL for Network Connections: Deprecated and insecure protocols

and use only TLS v1plus.
2) Email Server: Client (Mobile, Desktop, Web) Communications - HTTPS Email - TLS / SSL - TLS; default option.
3) Salted/Hashed Passwords: Local credentials protected using a salted MD5 hash, cloud credentials should use a complex multi-level hash.

d. The VMS will not require any licenses to increase the number of supported devices, users, or servers.

B. VMS Server Application:
1. Runs on the Following Operating Systems:
a. Microsoft:
1) Windows 10 IoT Enterprise.
2) Windows Server 2019 or later.
3) Windows 10 Enterprise Solutions.
b. Ubuntu Linux:
1) Ubuntu 14.04 LTS: Trusty Tahr.
2) Ubuntu 16.04 LTS: Xenial Xerus.
2. Minimum Compatible Computing Hardware:
a. Any hardware able to run a compatible operating system.
b. Capable of recording 128 dual-streaming IP cameras (256 streams) on a single core of an Intel Core i3 processor.
3. Initial Installation and Setup:
a. Publicly available, free download.
b. No prerequisite proprietary or 3rd party software and database technologies required during installation.
c. Installation Process: No user input once initiated.
d. After Installation is Complete: Setup process will allow system administrators to create a new system or to merge newly installed servers with existing systems.
4. Performance:
a. Automatically discover, stream, and record any ONVIF Profile S IP camera located on same subnet as server application.
b. Manually discover, stream, and record RTSP, HTTP, or UDP (multicast, unicast) streams.
c. Concurrent TCP Connections: 1000.
d. Record and Stream Video: Any resolution and frame rate, limited only by hardware.
e. Automatic camera failover without any additional licenses.
f. Unlimited number of users and custom user roles.
g. Any type of storage medium - HDDs, SSDs, SD cards, DAS, NAS, or other network-attached storage devices or locations.
h. User Login Credential Management: LDAP / Active Directory / Open LDAP integration.
i. Record and Stream
1) Video: H.264, H.265, and MJPEG.
2) Audio: AAC, PCM (Mu-Law, A-law), g726, and MP3.
j. Transcode Streams on Demand: For delivery to 3rd party system devices.

1) Codecs: H.265, H.264, MJPEG or WebM.

k. Pass-through high-res or low-res HLS streams from connected devices.
l. Store archive indices in same location as recorded video files.
m. Re-Index Archive Feature: Allow system administrators to recover archives from any storage medium.
n. Boolean Events Engine: Allow operators to program and trigger system actions based on system, connected device, or HTTP events sent from 3rd party system or device.
o. Send HTTP PUT or GET requests to 3rd party systems or devices.
p. Support Addressing: IPv4 or IPv6.
q. Operators to set custom network routing configurations for system servers to optimize network routing and usage.
r. Allow operators to monitor CPU, RAM, NIC, and HDD usage in real time.
s. Track all operator actions to allow audits.
t. Generate automatic crash files for every crash of the Server application.
u. Operator ability to change size of reserved disk space for storage drives.
v. Automatically disable any system drive (drive containing the operating system) in computing hardware with more than one drive to ensure operating system drive does not become full.
w. Configuration and events from binary I/O contacts on supported devices including IP cameras and I/O devices.
x. Send email notifications via SMTP using TLS, SSL or unsecured connections.
y. Scheduled backup of recording archives to local, networked, or cloud storage locations.
z. On-demand backup of recording archives to local, networked, or cloud storage locations.
aa. Concurrent-recording of all connected cameras / streams to two servers in real-time.
bb. Server-side, CPU-based motion analysis for all connected IP cameras with no perceptible increase, less than 3 percent, in CPU usage.
cc. Require no dedicated GPU in order to perform at maximum capacity.
dd. Web Administration Interface Allowances:
    1) System administrators to view real-time server health monitoring statistics; CPU, NIC, and HDD usage.
        a) Hidden advanced page giving system administrators ability to modify advanced system settings.
    2) Users to view live or recorded video from a single camera at a time in high or low resolutions.
    3) Users to view all available servers in system.
        a) Operators to disconnect the VMS Server from the VMS cloud application (if required).
        b) Operators to switch between server interfaces.
    4) Must support any RAID configuration of storage medium.

C. VMS Desktop Application:
1. Runs on the Following Operating Systems:

a. Microsoft:
    1) Windows 10.
    2) Windows Server 2019.
    3) Windows 10 Enterprise Solutions.
b. Ubuntu Linux:
    1) Ubuntu 14.04 LTS: Trusty Tahr.
    2) Ubuntu 16.04 LTS: Xenial Xerus.
        a) Apple / Mac.
    3) OSX 10.11: El Capitan.
    4) OSX 10.12: Sierra.
    5) OSX 10.13: High Sierra.

2. Minimum Compatible Computing Hardware:
    1) Any hardware able to run a compatible operating system with a CPU that supports OpenGL 2.1 and Intel HD Graphics 3000 (or higher).
    b. Will not require any dedicated graphics drive to work at full capacity; 64 streams on a 64 bit OS, 24 streams on a 32 bit OS, and use the CPU for all video decoding and rendering.
3. Installation and Configuration of VMS Client Application:
    a. Publicly available, free download.
    b. No prerequisite proprietary or 3rd party software and database technologies required during installation.
    c. Installation Process: No user input once initiated.
4. Performance and Basis Structure:
    a. Navigation Panel: Main menu button, an interactive cloud-login icon, tabbed layouts, minimize and maximize icons, a contextual help icon, and a close application icon.
    b. Resource Panel (Left): Contains all system resources (Servers, Devices, Users, Layouts, Offline files, etc.) with collapsible structure and a keyword search mechanism to allow operators to quickly search for a display live streams / cameras, offline video and image files, or any combination thereof.
    c. Notifications Panel (Right): Shows all system or rules-engine generated notifications which can be clicked on to display relevant resource in the viewing grid.
    d. Timeline Panel (Bottom): Allows for navigation and search of recorded video files.
    e. Viewing Grid (Main Viewing Area): A flexible adaptive grid interface which allows operators to create and share customized layouts of system resources.
5. Operation: Allow operators to do the following.
    a. View and interact with the following types of media:
        1) Live Streams: H.265, H.264, MJPEG.
        2) Offline Media: AVI, MKV, MP4, MOV, TS, M2TS, MPEG, MPG, FLV, WMV, 3GP, JPG, PNG, GIF, BMP, and TIFF.
        3) I/O Devices: Status and triggers.
        4) Servers: Real-time server health monitoring status.
    b. Scroll to and zoom in on any zone of viewing grid.

c. Drag and drop to reassign cameras from one server to another server.
d. Via a flexible timeline, view dates of any and all archived video in the System for a specific camera, or groups of cameras.
e. Manually Create Bookmarks: With start time, end time, name, description, and tags, for later search. Bookmarks must also be able to be created using the Rules engine.
f. Create Soft Triggers: Programmable, customizable buttons which sit on top of streams in Viewing Grid, to trigger any available system action.
g. Icons Located on the Top of Live Camera Streams: Dewarp fisheye cameras, control PTZ cameras, apply client-side image enhancement, execute smart motion search, create zoom windows, rotate items to any orientation, and activate stream or file info.
h. Create Zoom Windows: 63 zoom windows on a single item in a 64 bit OS, 23 zoom windows in a 32 bit OS; a magnified view of a part of a live stream, recorded videos, or static images.
i. Execute a Smart Motion Search: By selecting a subset of a live camera stream with results shown in red on the flexible timeline. Smart Motion search should be able to search a year (12 months, 365 days) of archived video in less than one second.
j. Search live cameras by name, manufacturer, IP address, MAC address, and status (e.g. live).
k. Search video archives by date and time with a responsive, adaptive timeline.
l. Operators to customize the background image of the application with supported image types.
m. Support digital mapping by allowing operators to add and customize background images including opacity and number of grid points.
n. Utilize adaptive scaling technology to automatically switch between high and low resolution streams during live and recording playback to optimize CPU and network usage.
o. Log in to the Cloud application (if utilized) in order to quickly connect to any shared system.
p. Quickly switch between previously connected or cloud-accessible systems (if utilized) using searchable tiles that show system name and status.
q. Using a Storage Analytics feature analyze storage capacity of the system based on available drives and real-time and historical bandwidth analysis.
r. Management and configuration of all system devices, users, and resources in a single unified interface.
s. Fast-forward and fast-reverse of archived video up to 16x normal speed.
t. Show operators which system server they are connected to.
u. Connect to previous versions by automatically downloading and switching to compatible versions.
v. Automatically discover available systems on the same network as the computer running the Desktop application.
w. Automatically recover and reconnect to a system in the instance the server the operator is connected to becomes inaccessible for any reason.

x. Show or hide adaptive thumbnails in the timeline panel.
y. Synchronize all items on a layout or disable synchronization to view live and recorded video at the same time.
z. Adaptive settings dialogs, to switch dialog content while the dialog is open by clicking on a resource.
aa. Batch configuration of camera recording schedules, fps, and quality.
bb. Drag and drop multiple system resources onto the Viewing Grid at the same time.
cc. Modify time synchronization settings for the system to utilize online resources (NTP servers) or to set a dedicated local time server.
dd. View a full list of system cameras and devices in a single dialog.
ee. View, Search and Export:
    1) All system events.
    2) All system bookmarks.
    3) System logs.
    4) Audit trail of operator actions and replay related video.
ff. Backup and restore system database.
gg. Create an unlimited number of custom user roles.
hh. Create and share lockable layouts.
ii. Update layouts in real time.
jj. Record their screen in full resolution and up to 30 fps.
kk. Add a local folder to add local files for search and playback.
ll. A Video Wall mode to control the application remotely.
mm. A Media Player mode to use the application as a media player.
nn. Remember past system connections and user credentials and will allow operators to quickly search for and switch between systems.
oo. Adjust aspect ratio and streaming quality (high resolution or low resolution) of items displayed on the viewing grid.
pp. Display I/O devices as an individual item on the viewing grid create custom names for inputs and output.
qq. Customize the layout of I/O panels on the item in the viewing grid including indicators for inputs and buttons for outputs.
rr. De-warp any fisheye lens using automatic calibration or manual calibration without the need for any third party SDKs.
ss. Create fully customizable viewing tours which include any combination of live video streams, offline videos, images, websites (or URLs), I/O devices, and Server health monitoring status.
tt. Modify and save a shared layout to affect an instantaneous change to that layout on the VMS Desktop application of any user connected to the system viewing that layout (when the system administrator saves the layout the layout will update in real time for any user viewing that layout).
uu. Support two-way audio between operators and supported devices.
vv. Support audio alerts as an action that can be played on users' computers or connected system devices.
ww. Support PTZ presets and tours.
xx. Support PTZ presets and tours in fisheye cameras using de-warp mode.

yy. Schedule recording for connected cameras and devices with options to force minimum and maximum storage durations.
zz. Configure pre and post recording for motion events.
aaa. Optimize camera streaming quality from connected devices automatically using low, medium, high, best quality selectors or manually in the camera.
bbb. Export video by selecting an area on the timeline and right clicking to export.
ccc. Support single video export in .avi, .mp4, or .mkv formats and will offer the option to transcode any client-side effects (image enhancement, de-warping, time stamps) as part of the exported video.
ddd. Support multi-video export in an executable format to create a fully portable version of the VMS Desktop application including all exported video files.
eee. A rapid review export feature which will allow operators to compress any length of video into a short video (e.g. export 8 hours of archives into a 30 second video clip).
fff. Activate or deactivate system licenses on Internet connected systems.
ggg. Force open an alarm layout triggered by any system or 3rd party event with one or many associated cameras or resources.
hhh. A hidden configurable method of increasing the amount of items allowed on the viewing grid.
iii. Adjust configuration of devices.
jjj. Force users to set the camera's initial password upon enrollment for best cyber security practices.

D. VMS Mobile Application (if required):
1. Runs on the Following Operating Systems:
   a. Google Android.
   b. Android 4.0: Ice Cream Sandwich.
   c. Android 4.1, 4.2, 4.3: Jelly Bean.
   d. Android 4.4: KitKat.
   e. Android 5.0: Lollipop.
   f. Android 6.0: Marshmallow.
   g. Android 7.0 7.1: Nougat.
   h. Android 8.0 8.1: Oreo.
   i. Apple iOS: 5, 6, 7, 8, 9, 10, and 11.
2. Installation: Application to be available as a free download from Google Play or Apple iTunes stores. *No additional licensing fees shall be required for the utilization of the VMS Mobile Application.*
3. Performance:
   a. Automatically discover available Systems on a local area network (LAN).
   b. Store past system connections and credentials and allow users to quickly search for switch between systems.
   c. Adaptive streaming and automatically adjust stream being displayed based on network speed.
4. User Capabilities:
   a. Adjust streaming resolutions manually.
   b. Search for cameras by name.

c. Fisheye de-warping of any fisheye lens without 3rd party SDK.
d. View live video from one system.
e. Log in to VMS Cloud layer to view and access systems shared with a user.
f. Control the display of any connected "Lite Clients" in the system.
g. Utilize a custom media player to render and display live thumbnails and video.
h. Search video using a calendar.
i. Search video using a flex timeline.

E. VMS Cloud Application (if utilized for off-site capabilities):
1. Supported Browsers: Allow users to log in from any modern web browser. (Google Chrome, Mozilla Firefox, Microsoft Edge, Opera, etc) from any type of device (mobile, PC, etc.)
2. Performance:
a. An optional add-on to VMS requiring no additional licensing.
b. Will first attempt a direct connection to system servers using NAT Traversal technology and be able to proxy traffic to ensure access to a system in case of ISP or routing issues.
c. Unlimited number of connected users and systems with no additional licensing.
d. Utilize secure networking technologies (OpenSSL, HTTPS) and a complex Salted MD5 hash for any stored.
e. Users to connect an unlimited number of systems to a single user account.
3. User Capabilities:
a. System Administrators:
1) Share access to a system using only an email address.
2) Assign custom user roles when sharing system access.
b. Users: Quickly search for and connect to cloud-connected systems by name.
c. Operators: View live or recorded video from one camera at a time on any cloud-connected system.
d. Passwords.

F. Digital Video Network Equipment
1. The digital CCTV network shall be a stand alone 1000 MB network furnished and installed by the Division 28 contractor. The owner’s network may be, at the option of the owner, linked to the digital video network for accommodation of remote viewing PC’s, but shall not be used as the primary means of transporting digital video.
2. Switches shall be 12, 24 or 48 port as applicable and defined below.
3. Each switch can operate as both a master controller and a forwarding processor.
4. Dynamic Host Configuration Protocol (DHCP) auto configuration of multiple switches through a boot server.
5. Dynamic Trunking Protocol (DTP) to facilitate dynamic trunk configuration across all switch ports.
6. Protocol Independent Multicast (PIM) for IP multicast routing is supported, including PIM sparse mode (PIM-SM), PIM dense mode (PIM-DM), and PIM sparse-dense mode. The IP Services image is required.
7. Inter-VLAN IP routing for full Layer 3 routing between 2 or more VLANs.
8. Distance Vector Multicast Routing Protocol (DVMRP) tunneling interconnects 2 multicast-enabled networks across non-multicast networks.

9. IEEE 802.1x allows dynamic, port-based security, providing user authentication.
10. IEEE 802.1x with VLAN assignment allows a dynamic VLAN assignment for a specific user regardless of where the user is connected.
11. IEEE 802.1x and port security are provided to authenticate the port and manage network access for all MAC addresses, including that of the client.
12. Port-based ACLs for Layer 2 interfaces allow security policies to be applied on individual switch ports.
13. VLAN trunks can be created from any port, using either standards-based 802.1Q tagging.
14. 4000 VLAN IDs are supported.
15. IGMP snooping provides fast client joins and leaves of multicast streams and limits bandwidth intensive video traffic to only the requestors.
16. Shall support Uni-cast routing protocol RIP v2.
17. Shall support Protocol Independent Multicast (PIM).
18. 32-Gbps switching fabric.
19. Electrical Specifications:
    a. PoE Support: 375 watts available for 24 ports with PoE+, 195 watts available for 24 ports with PoE.
20. Ethernet switches shall be as manufactured by Cisco or HP.

G. Equipment Racks
1. Division 28 Contractor shall provide one (1) – 19" LCD monitor at each NVR rack location to be able to view NVR/VMC/VI server(s) display. Monitor shall be rack mounted.
2. Division 28 Contractor shall provide combination keyboard/monitor shelf at each NVR location.
3. Division 28 Contractor shall provide a mounted KVM Switch and all required cables and power supplies when more than one NVR is installed in a rack location. KVM capacity shall support connection of all NVRs in a rack location.
4. All CCTV equipment is to be furnished with UPS backup per the UPS specification section. This includes PoE Ethernet Switch power. All 120 VAC camera circuits shall be connected to an emergency power circuit.
5. Top and bottom shall be 14-gauge steel, horizontal braces shall be 16-gauge steel welded to integral structural side panels of 16-gauge steel
6. Shall be fully enclosed and provided with front door, rear door, side panels and top panel with cooling fans.
7. Cooling fans shall be provided in a capacity to fully exhaust the heat dissipated by the equipment.
8. Rack shall come equipped with two pairs of 11-gauge steel rackrail with tapped 10-32 mounting holes in universal EIA spacing.
9. Contractor to provided 6 RU of blank space at the top to be enclosed using rack blank panels.
10. There shall be no spacing between components within the rack.
11. Equipment racks shall be Middle Atlantic Products or Atlas Soundolier.

H. Camera Poles:

1. The heavy-duty pole is for exterior applications and is designed to be weatherproof against the outdoor environmental element effects of discoloration and as well shall be designed to meet or exceed the local requirements for wind load resistance. The installer shall be responsible for checking the local codes for compliance.
2. The poles staff shall be round and extruded from all new 6063 alloy aluminum tubing and heat-treated to produce a T6 temper. The pole shaft shall be 6" in diameter by 18 feet tall non-tapered and shall be of one-piece seamless construction. Shafts with seams welded or not will not be acceptable.
3. The pole shaft shall be continuously welded to a 12" base plate. The base plate shall be cast from A356 aluminum alloy and tempered to Aluminum Association T6 standards.
4. The anchor bolts shall be fabricated from structural quality, hot rolled carbon bar, having a minimum yield strength of 50,000 PSI. The anchor bolts shall be an "L" design and shall be galvanized.
5. An extruded handhole to provide for internal wiring shall be provided and shall have a cover with tamper resistant security screws.
6. The unit shall be designed and manufactured to allow the conduit and wiring to be totally concealed and run within the unit.
7. The unit shall be finished in a standard dark bronze (DB) powder coating. Other finishes are available.
8. Concrete Mounting Base;
9. The pole shall mount to a round concrete base. The concrete base will be furnished under the General Construction Contract.
10. Poles shall be United Lighting Standards or approved equal.

PART 3 - EXECUTION

3.01 MANUFACTURER'S INSTRUCTIONS

A. Compliance: Comply with manufacturer's product data; including product technical bulletins, product catalog, installation instructions, submittal sketches or drawings, and product carton instructions for installation.

3.02 EXAMINATION

A. Site Verification of Conditions: Verify that related conditions, including equipment that has been previously installed under other sections, are acceptable for product installation in accordance with manufacturer's instructions.

B. All devices connected to equipment specified in this section shall bear the UL, cUL, or CSA label and comply with all applicable National Electrical Code (NEC) standards.

3.03 PREPARATION

A. Division 28 Subcontractor shall develop custom software as required to effect the functions of the system as dictated by the drawings and Specifications.

B. Division 28 Subcontractor shall provide equipment cabinets for installation of the control equipment and cable terminations to the equipment.

C. All equipment related to the system shall be factory tested before shipment.

3.04 INSTALLATION

A. Contractor shall furnish all equipment, labor, system setup, and other services necessary for the proper installation of the products/system as indicated on the drawings and specified herein.
B. Install in accordance with manufacturer's handling and installation instructions.
C. Install in accordance with all local and pertaining codes and regulations.
D. All equipment and systems shall be installed by the ESC. Subcontracting of equipment installation shall not be permitted.
E. Equipment shall be ready to use condition at end of installation.
F. Energize equipment in accordance with manufacturer's instructions.

3.05 PROTECTION AND CLEANING

A. Storage and Protection: Store materials protected from exposure to harmful environmental conditions and at temperature and humidity conditions recommended by the manufacturer.
B. Touch up, repair, or replace damaged components before Substantial Completion.
C. Remove temporary tags, coverings, and construction debris from interior and exterior surfaces of equipment. Remove construction debris from equipment area and dispose of debris.
D. Clean integral air filters, heatsinks, grills, and fans before Substantial Completion and Commissioning Services.

3.06 WARRANTY

A. The ESC shall provide a single source warranty for all supplied equipment specified in this section to be free of defects in material and workmanship for a period of one (1) year from the date of substantial completion.

END OF SECTION 280300 – February 5, 2025

SECTION 31 11 00
SITE CLEARING

PART 1 **– PRODUCTS (NONE)**

PART 2 **– EXECUTION**

2.01. CLEARING

A. Clearing shall consist of the felling, and cutting of trees into sections, and the satisfactory disposal of the trees and other vegetation designated for removal, including down timber, snags, brush, fences, rubbish and other objectionable material occurring within the area of construction, except such trees and vegetation as may be indicated or directed to be left standing. Only those trees, shrubs, lawns, sidewalks, fences, etc. that fall within the limits of construction or that interfere with proper construction practices shall be removed. Trees designated to be left standing within the cleared areas shall be trimmed of dead branches 1-1/2 inches or more in diameter. Limbs and branches to be pruned shall be cut to Natural Target Pruning standards by a certified arborist. Trees and vegetation to be left standing shall be protected from damage incident to clearing, grubbing, and construction operations, by the erection of timber 4' high chain link fencing barriers. Such barriers must be placed and be approved by the Owner before construction operations can proceed. Clearing shall also include the removal and disposal of structures that obtrude, encroach upon, or otherwise obstruct the work. Clearing operations shall be conducted so as to prevent damage by falling trees to trees left standing, to existing structures and installation, and to those under construction, and so as to provide for the safety of employees and others

2.02. TREE REMOVAL

A. Where indicated or directed, trees and stumps shall be removed from areas outside those areas designated for clearing and grubbing. This work shall include the felling of such trees and the removal of their stumps and roots. Trees shall be disposed of as hereinafter specified.

2.03. DISPOSAL:

A. Disposal of trees, branches, snags, brush, stumps, etc., resulting from the clearing and grubbing shall be the responsibility of the Contractor and shall be disposed of by removal from the site of this work. All costs in connection with disposing of the material will be at the Contractor's expense. All liability of any nature resulting from the disposal of the cleared and grubbed material shall become the responsibility of the Contractor. The disposal of all materials cleared and grubbed will be in accordance with the rules and regulations of the local, State, and Federal authorities.

2.04. GRUBBING:

A. Grubbing shall consist of the removal and disposal of stumps, roots larger than ½ inch in diameter, and matted roots from the designated grubbing areas. This material, together with logs and other organic or metallic debris not suitable for foundation and subgrade purposes shall be excavated and removed to a depth of not less than 18-inches below the original surface level of the ground in embankment areas and not less than 2-feet below the finished earth surface in excavated areas. Depressions made by grubbing shall be filled with suitable material and compacted to make the surface conform to the original adjacent surface of the ground.

2.05. REMOVE AND REPLACE FENCE

A. Where existing fences must be removed, the materials shall be removed neatly and stored carefully. Reinstallation of the fence shall match the line and height of the existing fence, except as directed by the Engineer, when fences are to be replaced. The existing materials may be used, provided they are not damaged. Any damaged materials shall be replaced with new material equal to and matching in appearance the existing material. Fences that are required for security of private or public property shall be reinstalled before the end of the workday in which they were removed.

2.06. REMOVE AND REPLACE MAILBOXES

A. Where existing mailboxes must be removed, they shall be removed neatly and stored carefully or installed in a temporary location as directed by the Engineer. Reinstallation of the mailboxes shall match their previous location and height. The existing materials shall be used, provided they are not damaged. Any damaged materials shall be replaced with new material equal to and matching in appearance the existing material.

2.07. REMOVE AND REPLACE SHRUBS AND GROUNDCOVERS

A. Shrubs and groundcovers that are to be retained shall be preserved and protected. Items that must be disturbed or relocated shall be carefully removed so as to prevent damage to the root systems, stored, and replanted as soon as possible after construction in the area is completed. Heeling in, mulching and regular watering are minimum preservation treatments.

2.08. REMOVE AND REPLACE SIGNS

A. Where existing signs must be removed, they shall be removed neatly and stored carefully or installed in a temporary location a directed by the Engineer. Reinstallation of the signs shall match their previous location and height. The existing materials shall be used, provided they are not damaged. Any damaged materials shall be replaced with new material equal to and matching in appearance the existing material.

END OF SECTION 31 11 00

SECTION 31 20 00
EARTHWORK

PART 1 - **GENERAL**

1.01 BENCHMARKS

A. Maintain two existing bench marks on the site for references. All vertical dimensions shall be checked from these bench marks.

1.02 FINISHED GRADES

A. Finished grades, as used herein, mean the final grade elevations indicated on the drawings. Should finished grades shown on spot elevations conflict with those shown by the contours, the spot elevations shall govern.

1.03 BORROW PITS

A. Submit representative samples of all fill material requiring compaction to the Designated Testing Laboratory. **Material and borrow pits shall be approved by the Contracting Officer prior to filling operations.** If the quantity available from site grading is not sufficient, purchasing, hauling, and blending of fill shall be done by the Contractor.

1.04 CONTROLLED FILL

A. Class I Fill is all Structural Fill to underside of slabs and to support foundations or footings. Class I Fill shall extend to 10 feet outside the building footprint.

B. Class II Fill is all Backfill below finish grade immediately behind walls and in trenches and embankments under walks, drives, parking areas, and all areas to be paved. The top two-feet of fill under drives and parking areas shall be Class I Fill. The area shall extend to 10 feet outside paved areas.

C. Class III Fill is all Backfill used for filling trenches not under paved or building areas.

1.05 DESIGNATED TESTING LABORATORY

A. **Services of a Designated Testing Laboratory (DTL) shall be incorporated as specified in Section 014000 – Quality Requirements.** Designated Testing Laboratory shall:

1. Witness proofrolling and make recommendations concerning undercutting loose subgrade areas and surface scarification.
2. Observe and make recommendations concerning surface drainage.
3. Perform Standard Proctor and field density test.
4. Provide advice concerning fill soils on site and the selection of borrow soils.
5. Evaluate the suitability of the subgrade soils at the foundation bearing level.
6. The Designated Testing Laboratory shall report to the Contracting Officer in writing the results of the tests including a statement that all tests have been performed as required by the specifications.

1.06 INSUFFICIENT FILL MATERIAL

A. If quantity of grading material is insufficient to provide finish grade elevations indicated on the drawings, obtain additional fill material of specified quality from an off-site source at no additional cost to the owner.

1.07 EXCESS CUT MATERIAL

A. If quantity of grading material is in excess of quantities required to provide finished grade elevations indicated on the drawings, any excess material shall be disposed of off-site at no additional cost to the owner.

PART 2 - **PRODUCTS**

2.01 MATERIALS

A. General: Where the terms "approved", "suitable", "unsuitable" and similar designations are used in specifications section pertaining to earthwork, it means earth or material designated as being approved, suitable or unsuitable, for their intended use by the soils technician of the Engineer.

B. Suitable Soil Materials are defined as those complying with ASTM D-2487 soil classification groups: GW, GP, GM, SM, SW, and SP.

C. Unsuitable Soil Materials are defined as those complying with ASTM D-2487 soil classification groups GC, SC, MH, ML, CL, CH, OL, OH, PT. Clays, silts, and organic soils will be considered as unsuitable materials. Excess water in materials will be a basis for establishing unsuitable material regardless of gradation.

2.02 FILL MATERIAL

A. Sand Fill (capillary water barrier) material shall consist of a clean sand with a fineness modulus of 1.6 to 3.1 and containing not more than 10 percent by weight finer than No. 200 U.S. Standard Sieve.

B. Structural Fill material shall consist of inorganic material free of roots, cobbles and boulders and classified as GM, GC, SW, SP, SM, SC, or CL by ASTM D2487-85 "Standard Methods for Classification of Soils for Engineering purposes". Earth Fill shall also conform to the following:

1. Liquid Limit=40 maximum
2. Plasticity Index=25 maximum
3. Dry Unit Weight=90 pcf minimum density (ASTM D 698)

C. SITE FILL MATERIAL

1. Material which does not conform to the above classifications, except Soil Classified CH, MH, OH, OL, and PT, may be used as Site Fill material under topsoil to establish site grades. Site Fill Material.

PART 3 - **EXECUTION**

3.01 SITE GRADING

A. Provide drainage away from the building walls, where not shown otherwise on the drawings, at a grade of at least 3-inches in 10-feet. Provide shallow swales where indicated on plans at a minimum width of 6-feet and minimum depth of 3-inches with a minimum flowline grade of not less than 1/8-inch per foot. Provide rounding at top and bottom of banks and at other breaks in grade.

3.02 GROUNDWATER CONTROL

A. Temporary sumps or gravity flow drainage ditches shall be excavated to a minimum depth of 3-feet around the area of construction to control the shallow ground water during the wet season.

3.03 RAINWATER, SURFACE WATER, AND BACK-UP

A. Protect all Work, including excavations and trenches, from rainwater, surface water, and back-up of drains and sewers. Furnish all labor, pumps, shoring, enclosures, and equipment necessary to protect and to keep work free of water.

3.04 GEOTECHNICAL EVALUATION AND UNDERCUTTING

A. After clearing, grubbing and topsoil removal is complete; contact the Designated Testing Laboratory (DTL) to evaluate the site areas under the new building.

B. The DTL shall evaluate the extent of the loose and/or contaminated fill material and the highly plastic material.

C. All material that is unsuitable or can not be compacted shall be undercut or re-worked in the presence of, and as recommended by, the DTL.

D. The contractor shall provide access and assistance to the DTL.

E. The DTL shall measure the in-place volume of undercut material and assist the owner in obtaining the in-place quantity for the purpose of determining the amount of additional payment to the contractor.

3.05 INSPECTION OF SUBGRADE, PROOFROLLING, SCARIFYING, AND COMPACTION

A. After stripping and excavation of the cut areas and removal on unsuitable materials as outlined in the preceeding section of this Specification, and prior to filling, the exposed subgrade shall be approved by the Contracting Officer. The exposed subgrade, enclosed by a line drawn 10 feet outside the building and paved areas, shall be predensified and proofrolled by rolling the surface with compaction equipment.

B. Rolling shall consist of a minimum of eight overlapping coverages in each of two perpendicular directions and shall continue until density test at a depth of 12 inches below the surface indicates the attainment of 98% of the Standard Proctor maximum, ASTM D 698. In cut areas under building foundations and slabs and pavements, the top one foot of the subgrade shall be compacted to of 98% of the Standard Proctor maximum.

C. The equipment used for rolling shall be a 20-ton, fully loaded, pneumatic tired tandem axle dump truck.

D. Proofrolling shall be performed in the presence of the Designated Testing Laboratory Representative.

E. Soft, loose or unstable surface zones which are detected during proofrolling and compaction shall be scarified and recompacted or undercut and replaced with controlled fill as directed.

F. Stockpile undercut materials by Fill Material classification in on-site locations where it will not interfere with construction operations. Materials stockpiled shall be placed in a manner to afford drainage. Protect against erosion.

G. Undercut materials which qualify as Structural Fill may be used in Class I & II Fill areas.

3.06 EXCAVATION

A. Excavate to elevations and dimensions, plus space to permit erection of forms.

B. All bottoms shall be clean cut, true, level, and sound. The bottom of all excavations shall be compacted to a density equivalent to 98% of the Standard Proctor Maximum (ASTM D698) at a depth of 12 inches. Any water softened soils in foundation excavations shall be removed or recompacted prior to steel and concrete placement.

C. At no extra cost to the Owner, carry foundations to bottom of any excavation erroneously carried too deep.

3.07 INSTALLATION OF CLASS I FILL

A. Class I Fill shall be Structural Fill material.

B. Compact within + 3 percent of optimum moisture content in 8-inch (maximum) loose layers to a density equivalent to 98 percent of the Standard Proctor Maximum (ASTM D 698).

3.08 INSTALLATION OF CLASS II FILL

A. Class II Fill shall be Structural Fill materials except that fill immediately behind walls and under floor slabs as indicated on drawings shall be Sand Fill material.

B. Compact within $\pm$ 3 percent of optimum moisture content in 8-inch loose layers to a density equivalent to 95 percent of the Standard Proctor Maximum (ASTM D 698). The top two feet under paved areas and the top one foot for other areas shall be Class I fill.

3.09 INSTALLATION OF CLASS III FILL

A. Class III Fill may be Structural Fill or Site Fill.

B. Compact fill in utility trenches not under buildings or paved areas to a density equivalent to 92 percent of the Standard Proctor Maximum (ASTM D 698).

3.10 INSTALLATION OF BACKFILL

A. Shore Foundation Walls which are to be tied into floor slabs prior to installation of Backfill and until slabs have been in place sufficient time to achieve strength and provide structural stability against overturning.

B. Where Backfill is required on both sides of walls, it shall be brought up in even layers so as not to provide an unequal lateral load.

C. Install Backfill against Foundation Walls only when directed by the Contracting Officer, and elsewhere as construction progress permits.

3.11 FINISH GRADING

A. All areas covered by the project, including excavated and filled sections and adjacent transition areas, shall be smooth graded and free from irregular surface changes.

B. Degree of finish shall be that ordinarily obtainable from either blade-grader or scraper operations, supplemented with hand raking and finishing, except as otherwise specified.

C. The finished surface of unpaved areas shall be not more than 0.05' feet above or below the established grade or designed cross-section. Grading shall be done in order that no ponding will occur.

D. Ditches shall be finished smooth to reduce erosion and permit adequate drainage.

3.12 DISPOSAL OF WASTE MATERIAL

A. All vegetation, roots, brush, sod, broken pavements, curb and gutter, rubbish, and other unsuitable or surplus material stripped or removed from the limits of construction shall be disposed of by the Contractor.

3.13 PROTECTION

A. Protect existing trees and shrubs at all times during earthwork operations. No trees shall be removed without prior acceptance of the Owner.

B. The Contractor shall be responsible for protection of all utilities shown on the drawings or indicated by the Owner at all times during earthwork operations.

C. Graded areas shall be protected from traffic, erosion, or settlement that may occur from any cause prior to acceptance.

D. Any repair or reestablishment of grades prior to final acceptance shall be at the Contractor’s expense.

PART 4 - TESTING

4.01 COMPACTION TESTING

A. General: Compaction of earth fill and all pavement subgrades shall be performed to the percentage of maximum standard or modified dry densities and to the depths as indicated below:

B. Roadway Subgrades: 98% Modified (ASTM Test D-1557) Compact top 12" in Parking areas and top 15" in Driveways.

C. Subgrades under pavement removed and replaced for utility installations: 98% Modified (ASTM Test D-1557) to 12 inch depth.

D. Structural Fill under all structures, slabs and steps: 98% Modified (ASTM Test D-1557). Compact top 12 inches of subgrade and each layer of fill.

E. Subgrade below Sidewalks and Curb and Gutters: 98% Modified (ASTM Test D-1557) Compact top 6 inches.

F. Unpaved Areas to be grassed, sodded or landscaped: 90% Modified (ASTM Test D-1557) full depth.

1. All other areas not described above: as directed by the Engineer.

G. Moisture Control: All compaction shall be performed at material moisture contents within 3 percentage points, plus or minus, of optimum. Where subgrade or layer of soil material must be moisture conditioned before compaction, uniformly apply water to surface of subgrade, or layer of soil material, to prevent free water appearing on surface during or

subsequent to compaction operations. Remove and replace, or scarify and air dry, soil material that is too wet to permit compaction to specified density. Soil material that has been removed because it is too wet to permit compaction may be stockpiled or spread and allowed to dry. Assist drying by dicing, harrowing or pulverizing until moisture content has reached satisfactory value.

H. Field Density Tests: Tests shall be made in accordance with ASTM Method D-1556 and/or ASTM 2922. Minimum testing frequency shall be based on the most stringent of the following requirements (as applicable). Additional tests may be required by the Engineer in areas deemed critical.

1. One every layer of fill
2. One every 200 cubic yards of fill
3. One every 250 square yards of roadway subgrade or fill
4. One every building subgrade
5. Areas where degree of compaction is in question
   a. If in opinion of Engineer, based on testing service reports and inspection, subgrades or fills which have been placed below specified density shall require additional compaction and testing.

4.02 TESTING INTERVAL

A. Existing Subgrade under Building Slabs and Paved Areas: One field density test for each 4,000 sf of building or paved area.

B. Class I and II Fills: One Field Density Test for each 8,000 sf of building area, 5,000 sf of paved areas after each lift of fill, and one test per 300 lineal feet of trench per one foot lift of fill.

C. Class III Fills: One field density test per 300 lineal feet of trench at a depth of one foot above pipe.

D. Exact locations of tests shall be as directed by the Contracting Officer. Submit five copies of test reports.

4.03 DENSITY TESTING IN FOUNDATIONS

A. One test per 100 linear feet of continuous grade beam and monolithic footing subgrade.

B. One test for every second column footing.

END OF SECTION 31 20 00

SECTION 31 25 00
EROSION AND SEDIMENTATION CONTROL

PART 1 – PRODUCTS

1.1 CHEMICALS FOR DUST CONTROL

A. Calcium Chloride, Anionic Asphalt Emulsion, Latex Emulsion or Resin-in-Water Emulsion may be used for dust control.

1.2 SILT FENCE FABRIC

A. Silt fence fabric shall be a woven fabric certified to meet FHWA's Task Force 25 minimum roll average per ASTM-D-4354. The geotextile fabric shall be a woven sheet of plastic yarn, of a long chain synthetic polymer composed of at least 85% by weight propylene, ethylene, amide, ester, or vinylidene chloride, and shall contain stabilizer and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra-violet and/or heat exposure. The fabric should be finished so that the filaments will retain their relative position with respect to each other. The fabric shall be free of defects, rips, holes, or flaws.

The fabric shall meet the following requirements:

Woven Fabrics	
Grab Strength	90 lbs.
Mullen Burst Strength	250 lbs.
UV Resistance	90%
Permittivity	15 gal/min/sf.

Product shall be equivalent to EXXON GTF-180 Fabric or AMOCO Woven Construction Fabric No. 1380.

"C" wire-reinforced silt fence shall be used where fill slopes exceed 3:1.

1.3 HAY BALES

A. Hay bales rectangular in shape shall be bound with wire or nylon to securely contain the material. Pine straw bales may be used in lieu of hay bales. Bales shall be placed in a single row, lengthwise, on the contour and embedded in the soil to a depth of four (4) inches. Bales must be securely anchored in place by two (2) re-bars driven into the ground a minimum of 1-1/2 feet.

1.4 PLASTIC FILTER FABRIC

A. Plastic filter fabric shall be a pervious sheet of plastic yarn, of a long chain synthetic polymer composed of at least 85% by weight propylene, ethylene, amide, ester, or vinylidene chloride, and shall contain stabilizers and/or inhibitors added to the base plastic to make the filaments resistant to deterioration due to ultra-violet and/or heat exposure. The cloth should be finished so that the filaments will retain their relative position with respect to each other. The cloth shall be free of defects, rips, holes, or flaws. During shipment and storage, the filter fabric shall be wrapped in a protective material. The fabric shall meet the following requirements.

Woven Fabrics:	
Tensile Strength (any direction)	200 lbs.
Bursting Strength	400 psi
Elongation Before Breaking	15%
Permittivity	4 gal/min/sf

Product shall be equivalent to EXXON GTF-400E or AMOCO Woven Construction Fabric

No. 2002.

B. Seams - Fabric may be sewn together with thread of a material having the same chemical requirements as the material forming the fabric or shall be bonded by cementing or by heat. The strength of the seams shall be equal to that of the un-aged fabric. Fabrics to be used under Rip-Rap are allowed to be bonded or sewn together forming sections not less than six feet wide.

1.5 STONE

A. Stone shall be hard quarry, granite or field stone and shall be of such quality that the stone will not disintegrate on exposure to water or weather. The stone size, type and weight shall be as shown in conjunction with the structure with which it is associated. The stone shall be accepted by the Architect prior to delivery.

1.6 RIP-RAP

A. Rip-rap shall be hard quarry or field stone, and shall be of such quality that they will not disintegrate on exposure to water and weather. The stone shall range in weight from a minimum of 25 pounds to a maximum of 150 pounds. At least 50 percent of the stone pieces shall weigh more than 60 pounds. The stone pieces shall have a minimum plane dimension of 12 inches. The stone analysis, source and other pertinent data shall be submitted for review by the Architect prior to delivery. The filter fabric for permanent Rip-rap shall be Mirafi 140N or equivalent. Rip Rap shall not be placed on slopes steeper than 1.5 horizontal to 1.0 vertical.

PART 2 – EXECUTION

2.1 GENERAL

A. Every effort shall reasonably be employed by the Contractor to control erosion with the use of, but not limited to, terraces, grassing, and silt fencing during the project. All erosion and sedimentation control measures or facilities, whether temporary or permanent, shall be continuously maintained by the Contractor so as to be effective, or as ordered by the **Design Professional**.

2.2 BUFFER ZONE

A. Buffer zone is an undisturbed zone or "green belt" surrounding the site, bordering streams or environmentally sensitive areas. Contractors shall not trespass on or in these areas unless he has prior acceptance by the **Design Professional**. Trespass in these areas will not be permitted unless there is no alternative method to accomplish the task. Cost shall not come into consideration in the evaluation of this type of request.

2.3 CONSTRUCTION EXIT

A. Construction exits shall be located at the exits of the project to remove mud from the tires of all vehicles leaving the site. The construction exit shall consist of a minimum of six (6) inch thick pad of washed stone meeting Section AASHTO M288-96, Section 7.4, Stabilization Requirements. The aggregate size shall be in accordance with National Stone Association R-2 (1 ½"-3 ½" diameter in size and of the necessary length to accomplish the task for which it is intended. The pad may require periodic top dressing with 2" of similar stone. Geotextiles are required and a Separation/Stabilization fabric to keep the aggregate stone from becoming contaminated with sub grade soils. The geotextile shall be based on AASHTO M288-96 Specifications. The entrance area must be excavated to a depth of 3 inches and be cleaned of all vegetation and roots.

Geotextile underliner must be placed the full length and width of the entrance.

2.4 DISTURBED AREA STABILIZATION

A. Vegetative cover will be placed on completed areas. This vegetative plan will be carried out on road cut and fill slopes, shoulders, and other critical areas created by construction. Plant grass seed as soon as construction in an area is completed. Planting will be made to control erosion, to reduce damage from sediment and runoff to downstream areas and to improve the safety and beauty of the development area. Due to grading and construction, the areas to be treated are mainly subsoil and substrate. Fertility is low and the physical characteristics of the exposed material are unfavorable to all but the hardiest plants.

Conventional Seeding Equipment - Grade, shape and smooth where needed to provide for safe equipment operation at seeding time and for maintenance purposes. The lime and fertilizer in dry form will be spread uniformly over the area immediately before seedbed preparation. A seedbed will be prepared by scarifying to a depth of 1 to 4 inches as determined on site. The seedbed must be well pulverized, smoothed and firmed. Seeding will be by either a cultipacker-seeder, drill, rotary seeder, mechanical seeder, hand seeder or hydro-seeding. Seed will be distributed uniformly over a freshly prepared seedbed and covered lightly. Within 24 hours after seeding, with exception to hydro-seeding, straw or hay mulch will be spread uniformly over the area, leaving about 25 percent of the ground surface exposed. Mulch will be spread with blower-type mulch equipment or by hand and anchored immediately after it is spread. A disk harrow with the disk set straight or a special packer disk may be used to press the mulch into the soil.

The per acre application rates are as follows using conventional seeding equipment on slopes less than 3:1:

1.

Soil Treatment	Application Rate/Acre
Agricultural limestone	4000 #/acre
Fertilizer, 10-10-10 (with micro-nutrients)	1500 #/acre
Mulch, straw or hay	4000 #/acre

2.

Seed Species	Application Rates/Acre	Planting Dates
Hulled common Bermuda grass	10 #	3/1 - 9/30
Rye grass		
Hay mulch for Temporary cover	50 # 4000 # N/A	10/1 - 2/28

Top-dressing: Apply when plants are 2 to 4 inches tall
Fertilizer (Ammonium Nitrate 33.5%) at 300 #/acre

If the project extends in to the second year, fertilizer shall be applied at the rate of 800 #/acre.

2.5 DUST CONTROL ON DISTURBED AREAS

A. Dust raised from vehicular traffic will be controlled by wetting down the access road with water or by the use of a deliquescent chemical, such as calcium chloride, if the relative humidity is over 30%. Chemicals shall be applied in accordance with the manufacturer's recommendations. Calcium chloride, anionic asphalt emulsion, latex emulsion or resin-in-water emulsion may be used for dust control.

2.6 SEDIMENT BARRIER

A. Sediment barrier shall be constructed of hay bales (pine bales) anchored and embedded into the soil to prevent washout or water washing under the barrier. A minimum of two (2) re-bars, steel pickets or 2" x 2" stakes shall be used per bale and shall be long enough to

extend through the bale and be driven into the ground a minimum of 1-1/2 feet. Where two (2) rows are called for, the bales shall be staggered. Bales shall be embedded in the soil to a depth of 4 inches.

Bales shall be placed in a single row, lengthwise, on the contour and embedded in the soil to a depth of four (4) inches. Bales must be securely anchored in place by stakes or bars driven through the bales.

2.7 SILT FENCE

A. Silt fence shall be placed at the approximate location shown on the plans and installed in accordance with the local standards. Type “C” wire-reinforced silt fence shall be used where fill slopes exceeds 3:1. Silt fence shall not be placed in waterways or areas of concentrated flow.

2.8 STONE PLACEMENT

A. The minimum thickness or depth of the stone layer shall be shown on the drawings or the detail with which the device is associated. When used with a plastic filter fabric, the stone placing shall begin in a trench at the bottom of the slope with the filter fabric wrapped in stone. The entire mass of stone shall be placed so as to be in conformance with the lines, grades, and thickness shown on the drawings.

2.9 RIP-RAP

A. Rip-rap shall be placed in accordance with the notes on the drawings. Any rip rap that shall be permanent shall have an underlayment of filter fabric.

2.10 STORM DRAIN OUTLET PROTECTION

A. Storm drain outlets shall be paved or have a rock or other energy dispersion device associated with it, as called for on the drawings. The length shall be a minimum of six (6) times the pipe diameter and placed on a 1% grade unless otherwise specified on the drawings.

To prevent undermining of the rip-rap apron a separation geotextile shall be used beneath the entire length of apron. The geotextile shall be specified in accordance with AASHTO M288-96, “Permanent Erosion Control Requirements”.

2.11 INLET SEDIMENT TRAP

A. The Contractor shall erect silt fence or hay bales at and around inlets under construction. Existing inlets in paved areas shall be protected by the use of concrete blocks wrapped with filter fabric as per detail. Sufficient quantities of selected devices shall be utilized to completely protect the entire length of the inlet. Contractor may alternately construct a temporary baffle in the inlet on the effluent pipe per detail providing that accumulated sediment be removed after each erosion event.

2.12 SITE RESTORATION

A. The site shall be restored in a manner suitable to accommodate the erosion control device or system of devices for the use which they are intended.

2.13 TOPSOIL

A. Topsoil stockpile side slopes shall be 2:1 or flatter. Stockpiled topsoil shall not obstruct natural drainage. Topsoil replacement shall be spread at minimum of 4" thickness.

2.14 SITE SAFETY

A. The Contractor shall incorporate and utilize all necessary fencing and other safety barriers as necessary, or directed by Owner, to prevent trespassing into potentially dangerous areas of the erosion control area.

END OF SECTION 31 25 00

SECTION 36 12 16
ASPHALTIC CONCRETE PAVING

PART 1 - GENERAL

1.01 DESCRIPTION:

A. Work included:

Asphaltic concrete paving required for this Work is indicated on the Drawings and includes, but is not necessarily limited to:

1. Streets.
2. Driveways.
3. Parking areas.

B. Related work described elsewhere:

1. Demolition, Clearing and Grubbing: Section 024100.
2. Earthwork: Section 310000.

1.02 QUALITY ASSURANCE:

A. Qualifications of workmen:

1. Provide at least one person who shall be thoroughly trained and experienced in the skills required, who shall be completely familiar with the design and application of the Work described for this Section, and who shall be present at all times during progress of the Work of this Section and shall direct all Work performed under this Section.
2. For actual finishing of paved surfaces and operation of the required equipment, use only personnel thoroughly trained and experienced in the skills required.

B. Codes and references standards:

1. Reference to standard specifications shall mean South Carolina Department of Transportation Standard Specifications, latest edition.
2. Comply with all Federal, State and local laws, codes, regulations and standards.

1.03 PRODUCT HANDLING:

A. Protection: Use all means necessary to protect pavement materials before, during, and after installation and to protect the installed Work and materials of all other trades.

B. Replacements: In the event of damage, immediately make all repairs and replacements necessary to the approval of the Architect and at no additional cost to the Owner.

C. Dust control:

1. Use all means necessary to prevent the spread of dust during performance of the Work of this Section.
2. Thoroughly moisten all surfaces as required to prevent dust being a nuisance to the public, neighbors, and concurrent performance of other Work on the job site.

1.04 **JOB CONDITION:**

A. Traffic and services:

1. Arrange work to cause a minimum of disturbance to normal pedestrian and vehicular traffic.
2. Provide adequate means of access to all public and private properties during all stages of construction.

PART 2 - PRODUCTS

2.01 BASE:

A. Base shall conform to standard specifications and shall consist of either mixed-in-place soil cement base, premixed soil cement base or graded aggregate base, unless otherwise shown on the construction drawings. Where mixed-in-place or premixed soil cement base is elected, cement content shall be of such amount as confirmed by an independent testing laboratory to meet all requirements of the standard specifications, based on actual material being mixed with the cement. In no case shall the cement content be less than seven percent (7%) cement by volume.

2.02 **PRIME COAT:**

A. The prime coat shall be grade MC-70 as described in the Standard Specifications.

2.03 **SURFACE TREATMENT:**

A. Single surface treatment when required shall be in accordance with the Standard Specifications and as shown on Construction Drawings.

2.04 **TACK COAT:**

A. The tack coat shall be as described in the Standard Specifications.

2.05 **BITUMINOUS PLANT MIX:**

A. Mix design by Contractor:

1. Design the mix in accordance with the referenced standards and for the proposed use.
2. Secure the Architect's approval of the mix design prior to start of paving operations.

B. Standard mix design: The bituminous plant mix shall be in accordance with Construction Drawings and the Standard Specifications using asphaltic concrete type E or F applied at the average rate of one-hundred ten (110) pounds per square yard for an approximate thickness of one (1) inch, one-hundred sixty-five (165) pounds per square yard for an approximate thickness of one and one-half (1 1/2) inches, etc.

C. Selection of mix design: Mix design will be selected by the Contractor and approved by the Architect as best suits local conditions at the time of construction. Selection of mix design may be based on the requirements of paragraph A, above. Design the mix in accordance with all Plans, Specifications and Construction Details.

2.06 **MATERIALS:**

A. All materials shall conform to the applicable requirements of the Standard Specifications.

PART 3 - EXECUTION

3.01 **SURFACE CONDITIONS:**

A. Inspection:

1. Prior to all work of this Section, carefully inspect the installed Work of all other trades and verify that all such Work is complete to the point where this installation may properly commence.
2. Verify that pavement may be installed in strict accordance with the original design, all pertinent codes and regulations, and all pertinent portions of the referenced standards.

B. Discrepancies:

1. In the event of discrepancy, immediately notify the Architect.
2. Do not proceed with installation in areas of discrepancy until all such discrepancies have been fully resolved.

3.02 **EQUIPMENT:**

A. Compacting equipment: Equipment for compacting asphaltic concrete pavement shall be in accordance with the Standard Specifications.

B. Coating and mixing equipment: All equipment for prime coating, tack coating, mixing soil cement base and other coating or mixing operations shall be specifically designed for that purpose and shall be in accordance with the Standard Specifications.

C. Paving Equipment: All equipment for paving shall be spreading, self-propelled asphalt paving machines capable of maintaining line, grade, and minimum surface course thickness specified and shall be in accordance with the Standard Specifications.

3.03 **BASE:**

A. Construct base course in accordance with Construction Drawings and the Standard Specifications. Obtain approval of base construction from the Architect prior to proceeding with surface treatment.

3.04 **PRIME COAT:**

A. Apply the prime at the rate of 0.10 to 0.20 gallons per square yard in accordance with the Standard Specifications.

3.05 SURFACE TREATMENT:

A. When Construction Drawings indicate that a single surface treatment is required, construct the single surface treatment in accordance with requirements of the Standard Specifications.

3.06 **TACK COAT:**

A. Construct the tack coat in accordance with the Standard Specifications.

3.07 **BITUMINOUS PLANT MIX SURFACE COURSE:**

A. Construct the bituminous plant mix surface course in accordance with construction drawings and the Standard Specifications.

3.08 **FINISH TOLERANCES:**

A. Finish all surfaces to the following tolerances:

1. Base course: Plus 0.00 feet to minus 0.10 feet from line and grade shown on the Drawings.
2. Asphaltic concrete: Plus or minus 0.03 feet at any point from line and grade shown on the Drawings, but in no case shall there be a depression that holds water deeper than one-eighth (1/8) inch.

3.09 **REMEDIAL MEASURES:**

A. Upon direction of the Architect; cut out and/or rework all surfaces and subgrade areas which do not meet the requirements of this Section; perform all remedial measures at no additional cost to the Owner.

3.10 **METHOD OF MEASUREMENT:**

A. Asphaltic concrete paving shall be measured along the surfaces actually paved.

END OF SECTION 32 12 16