



VLK | ARCHITECTS

**OWNER:**

**Galveston  
Independent School District**  
3904 Avenue T  
Galveston, TX 77550

**PROJECT  
MANUAL**

March 24, 2022

**CENTRAL MIDDLE SCHOOL  
RENOVATIONS**  
GALVESTON I.S.D.  
GALVESTON, TEXAS

VLK Project No.  
**21.136.01**





Project Manual

for

## Central Middle School Renovations

VLK Architects Project No.: 21-136.01

for the

## GALVESTON INDEPENDENT SCHOOL DISTRICT

March 24, 2022

### Board of Trustees

Anthony Brown, President  
Johnny Smecca, Vice President  
Shae Jobe, Secretary  
Elizabeth Beeton, Trustee  
David H. O'Neal Jr., Trustee  
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### Administration

Dr. Jerry Gibson	Superintendent
Paul Byers	Director of Facility Services
Vikki Curry	Assistant Superintendent for Teaching and Learning
Michael Le	Director of Management Information Systems (MIS)
Connie Morgenroth	Assistant Superintendent of Business & Operations
Matthew Neighbors	Executive Director of Secondary Education
Mary Patrick	Executive Director of Special Programs ECH/Homeless and Foster Care Liaison
Jeff Post	Executive Director of Elementary Education
Annette Scott	Assistant Superintendent for Student Support







Project Manual

for

## Central Middle School Renovations

VLK Architects Project No.: 21-136.01

for the

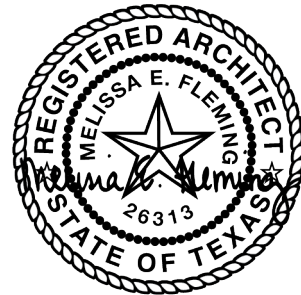
## GALVESTON INDEPENDENT SCHOOL DISTRICT

March 24, 2022

### Team

#### Architect

VLK Architects, Inc.  
Melissa Fleming, AIA  
20445 SH 249, Suite 350  
Houston, Texas 77070  
Main Phone: 281.671.2300  
www.vlkarchitects.com

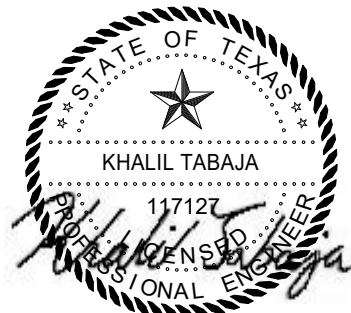


03/24/2022

Matrix Structural Engineers  
TBPE Firm Registration No. F-2640

#### Structural Engineer

Matrix Structural Engineers  
Firm Registration Number: F-2640  
Khalil Tabaja, P.E.  
5177 Richmond Ave. Suite 670  
Houston, Texas 77056  
Main Phone: 713.664.0130  
www.matrixstructural.com



03/24/2022



**MEP**

Salas O' Brien

Firm Registration Number: F-4111

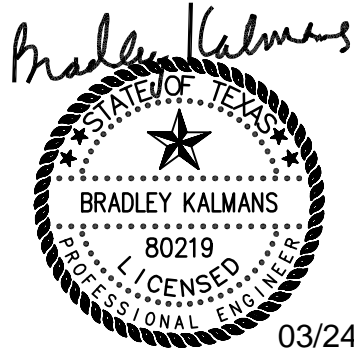
Brad Kalmans, P.E.

10930 W Sam Houston Pkwy N Ste 900

Houston, Texas 77064

Main Phone: 281.664.1900

[www.salasobrien.com](http://www.salasobrien.com)

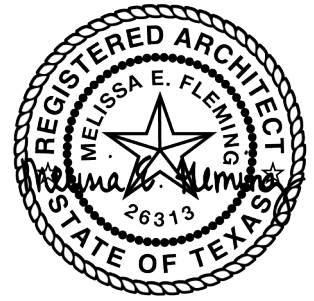


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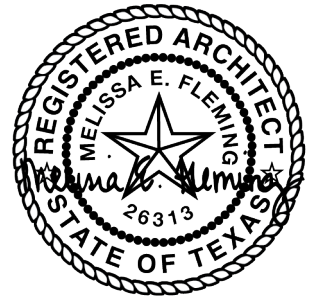
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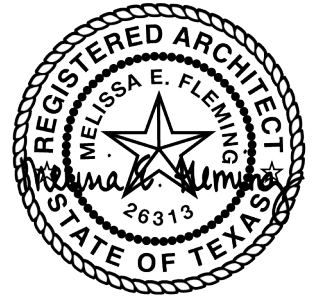
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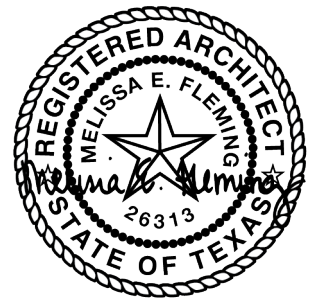
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**DOCUMENT 00 11 19**

**REQUEST FOR COMPETITIVE SEALED PROPOSALS**

Competitive Sealed Proposals for the work identified below in accordance with Proposal Documents and addenda as may be issued prior to date of proposal opening will be received by the Board of Trustees, Galveston Independent School District, until proposal closing date and time, as identified below. Proposals from Offerors will then be opened in public and read aloud.

**OWNER:** Galveston Independent School District  
3904 Avenue T  
Galveston, Texas 77550

**ARCHITECT:** VLK Architects, Inc.  
20445 SH 249, Suite 350  
Houston, TX 77070  
(281) 671-2300

**PROJECT:** Central Middle School Renovations  
Galveston Independent School District  
Galveston, Texas

**BUDGET:** \$800,000.00

**PRE-PROPOSAL** Thursday, March 31, 2022; 10:00 AM at Central Middle School, 3014 Sealy Avenue, Galveston, TX 77550. Representatives of the Architect, Owner and Consulting Engineers will be present at this meeting. All Offerors are encouraged to attend.

**QUALIFICATION STATEMENT SUBMISSION** Monday, April 11, 2022, by 5:00pm.  
Contractor's Qualification Statement shall be submitted to Architect's office at address listed above.

**PROPOSAL DATE AND TIME:** Thursday, April 14, 2022, 2:00PM

**LOCATION OF PROPOSAL OPENING:** Galveston Independent School District  
Purchasing Department  
3904 Avenue T  
Galveston, TX 77550

Proposal Documents will be available after March 23, 2022. Qualified Offerors (General Contractors) may obtain a free electronic copy of the Drawings and Project Manual or may obtain two hard copies upon deposit.

A link to the digital copies of the drawings and project manual may be obtained from Michelle Gallup, VLK Architects, Inc., 20445 SH 249, Suite 350, Houston, TX 77070, e-mail: [mgallup@vlkarchitects.com](mailto:mgallup@vlkarchitects.com). A link to the digital copy of the addenda will be e-mailed to the current list of plan holders.

In addition, proposal documents can be reviewed at the following locations:

iSqFt  
<https://www.isqft.com>

CMD Group  
[www.cmdgroup.com](http://www.cmdgroup.com)

Dodge Data & Analytics  
[www.construction.com](http://www.construction.com)

Questions must be submitted no later than Tuesday, April 5, 2022 via email to [mgallup@vlkarchitects.com](mailto:mgallup@vlkarchitects.com). Responses will be provided via an addendum.

Central Middle School Renovations  
Galveston ISD  
Galveston, Texas

All proposals must be in the hands of the Owner no later than the time specified above. Please seal all proposals in duplicate in an envelope with the following information on the face of the envelope.

Name of Offeror (General Contractor)  
**RFCSP 2021-22-012 Central Middle School Renovations**  
Galveston Independent School District

The Owner reserves the right to reject any and all proposals and to waive any irregularities in the Competitive Sealed Proposal process. No proposal shall be withdrawn within 30 days after the proposal opening without the specific consent of the Owner.

**PROPOSAL BOND:** A Proposal Bond from a bonding company acceptable to the Owner or a certified check in an amount equal to 5 percent (5%) of the greatest amount of proposal must accompany each offeror's proposal.

**PAYMENT BOND AND PERFORMANCE BOND:** A Payment Bond and Performance Bond, each in an amount equal to 100 percent (100%) of the Contract Sum conditioned upon the faithful performance of the Contract will be required. Please note that all bonding companies presented must be acceptable to the Owner.

The prevailing rates of wages are the minimums that must be paid in conformance with all applicable laws of the State of Texas.

All Offerors submitting a proposal are encouraged to attend the proposal opening. Subcontractors and suppliers intending to submit proposals to Construction Offerors are required to prepare their proposals based on a complete set of proposal documents. If after reviewing the complete set of proposal documents, Subcontractors and supplier offerors desire to purchase individual drawings and specification sections for their proposal convenience, they may do so by ordering the specific drawings and specifications directly from the reproduction company. Each offeror purchasing a partial set of proposal documents is responsible for determining exactly which documents he requires and is responsible for all costs associated with printing and delivery. Subcontractors and suppliers exercising this option must agree to do so on the basis that 1) all documents shall be returned to the Architect, without refund, after submitting a proposal and 2) documents shall not be used on other projects. Successful Subcontractors and supplier offerors may retain their Proposal Documents until completion of the construction.

All Offerors submitting a proposal are encouraged to visit the site.

END OF DOCUMENT

DOCUMENT 00 21 16

INSTRUCTIONS TO PROPOSERS

PART 1 - GENERAL

1.1 DOCUMENTS

- A. Reference DOCUMENT 00 11 19 - REQUEST FOR COMPETITIVE SEALED PROPOSALS for instructions on attaining Proposal Documents.

1.2 DEFINITIONS

- A. All definitions set forth in the General Conditions of the Contract for Construction, AIA Document A201, 2017 Edition and Section 01 42 16 - Definitions, are applicable to these Instructions to Proposers.
- B. Proposal documents include the Request for Proposals, Instructions to Proposers, the Proposal Forms and the proposed Contract Documents including Addenda issued prior to receipt of proposals.
- C. Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the proposal documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.
- D. "VLK Architects, Inc." will be hereafter referred to in this Project Manual as "Architect" and correspondence shall be addressed to: 20445 SH 249, Suite 350, Houston, TX 77070.

1.3 EXAMINATION OF DOCUMENTS AND SITE

- A. Each proposer, by making their Proposal, represents that they have read and understand the Proposal Documents.
- B. Each proposer, by making their Proposal, represents that they have visited the site, performed investigations and verifications as necessary and familiarized themselves with the local conditions under which the Work is to be performed and will be responsible for errors in their proposal resulting from their failure to do so.
- C. Each proposer by making their proposal represents that their proposal is based upon the materials, systems and equipment required by the Proposal Documents without exception.

1.4 QUESTIONS

- A. Proposers shall submit questions about the Proposal Documents to the Architect in writing not later than ten days prior to the date of receipt of the proposals. Replies will be issued to proposers as an addendum to the Proposal Documents and shall become a part of the Contract. The Architect and Owner will not be responsible for oral clarification.

1.5 SUBSTITUTIONS

- A. Each proposer represents by submitting their proposal that their proposal is based upon the materials and equipment described in the proposal documents.

1.6 PROPOSAL SECURITY

- A. A certified check; cashier's check; signed, dated and embossed proposal bond in an amount equal to 5% of the largest possible total proposal and made payable to the Owner must accompany each proposal. This shall be considered as the amount of liquidated damages which the Owner will sustain by failure or refusal of the proposer to execute and deliver the contract and the statutory performance and payment bonds should the Contract be awarded him.
- B. If the proposer defaults in executing and delivering the Contract and the statutory performance and payment bonds within ten days after written notification from the Architect of the award of Contract to him, then the

check or proposal bond shall become the property of the Owner, not as a penalty, but as liquidated damages, as payment for damages due to excess costs, delay and other inconveniences.

- C. Proposals shall remain in effect for a period of 30 days after the time established for receipt thereof, and during this time the Owner may accept or reject the proposals as he so elects. If the proposal is not accepted within 30 days after the time set for submission of proposals, or if the successful proposer executes and delivers said contract and the performance and payment bonds, then the check or proposal bond will be returned.
- D. Proposal Bond shall be executed by a Surety Company that is:
  - 1. Approved by the school district, and duly authorized and admitted to do business in the State of Texas as determined by the State Board of Insurance.
  - 2. Listed by the United States Department of the Treasury in that issue of the "Federal Register" covering the date on which the bond was executed and the date that Surety Company has obtained reinsurance, if applicable, from a reinsurer that is authorized and admitted as a reinsurer in this state and is the holder of a certificate of authority from the United States secretary of the treasury.
- E. Facsimiles or copies of Proposal Bond will not be acceptable. Submit fully executed originals of required documents.

#### 1.7 STATUTORY PERFORMANCE BOND AND STATUTORY LABOR AND MATERIAL PAYMENT BOND

- A. A Statutory Performance Bond and a Statutory Labor and Material Payment Bond will be required of the successful proposer and shall be executed by a surety company acceptable to the Owner and authorized to do business in the State of Texas. Each bond shall be in an amount equal to one hundred percent (100%) of the contract price. The Performance Bond and the Labor and Material Payment Bond may be in one or separate instruments in accord with local law and are to be delivered to the Owner no later than the date of execution of the contract. Failure or neglecting to deliver said bonds, as specified, shall be considered as having abandoned the contract and the proposal security will be retained as liquidated damages.
- B. Bonds shall be executed by a Surety Company that is:
  - 1. Approved by the school district, and duly authorized and admitted to do business in the State of Texas as determined by the State Board of Insurance.
  - 2. Listed by the United States Department of the Treasury in that issue of the "Federal Register" covering the date on which the bond was executed and the date that Surety Company has obtained reinsurance, if applicable, from a reinsurer that is authorized and admitted as a reinsurer in this state and is the holder of a certificate of authority from the United States secretary of the treasury.

#### 1.8 SUBMITTAL

- A. Submit proposals in accordance with the Request for Proposals. Enclose proposal in an opaque, sealed envelope. Clearly mark on the outside of the proposal envelope:
  - 1. RFCSP 2021-22-012 Central MS Renovations
  - 2. Name of proposer
- B. Preparation of Proposals: Proposals shall be submitted on unaltered proposal forms furnished by the Architect. Fill in all blank spaces. If there are entries (blank spaces) on the proposal form which do not apply to a particular proposer, these entries shall be marked "N.A." (Not Applicable) by the proposer. No proposals will be considered that are amended or are qualified with conditional clauses, alterations, items not called for in the proposal, or irregularities of any kind which, in the Owner's opinion, may disqualify the proposer.
- C. Contractor's Qualifications Statement shall be submitted separately to the Architect's office on date and time as stated in DOCUMENT 00 11 19 – REQUEST FOR COMPETITIVE SEALED PROPOSALS.
  - 1. Proposers must complete each item of the Contractor Information and Experience Statement (AIA Document A305). The Statement forms may be obtained from the Houston Chapter of the American Institute of Architects, 902 Commerce St, Houston, TX 77002, (713) 520-0155. In addition to the information contained in the Statement form, Proposers shall also address the selection criteria issues listed within Paragraph 1.10 for Determination of Successful Respondent and Award of Contract. The Contractor's Qualification Statement, proposed project team inclusive of resumes for all project staff, and other requested information shall be submitted prior to the receipt of Proposals.
- D. Each proposer shall submit one original, three duplicate copies, and one digital copy saved on a USB Flash Drive of each of the following. All shall be submitted in a single sealed envelope. Electronic signatures are acceptable.:

1. Proposal Form
2. Certification of Prohibited Contracts with Certain Companies and Not Boycott Israel
3. Non-collusion Affidavit
4. Felony Conviction Notice
5. Certification of Criminal History Record Information Review by Contractor-Employer
6. SB 13 and SB 19 Certification
7. Certificate of Residency
8. Conflict-of-interest Questionnaire

#### 1.9 MODIFICATION AND WITHDRAWAL

- A. No proposal may be changed, amended or modified after submittal. Proposers may withdraw proposals prior to proposal opening.

#### 1.10 DETERMINATION OF SUCCESSFUL RESPONDENT AND AWARD OF CONTRACT

- A. In determining the Selected Offeror, the Owner will evaluate the information derived from the Offeror's (Contractor's) Qualification Statement required herein, the information submitted on the Proposal Form, and other selection criteria including the following Selection Criteria:

Criteria	Weight
<b>Price: Base &amp; Alternates</b>	<b>30%</b>
▪ <i>Proposal Form</i>	
<b>The Offeror's experience and reputation</b>	<b>20%</b>
▪ <i>AIA A305 Exhibit A.2 Experience</i>	
▪ <i>AIA A305 Exhibit A.4 References</i>	
▪ <i>AIA A305 Exhibit C.2 Experience Related to the Project</i>	
▪ <i>AIA A305 Exhibit E Contractor's Past Project Experience</i>	
<b>The quality of the Offeror's goods or services</b>	<b>10%</b>
▪ <i>AIA A305 Exhibit A.3 Capabilities</i>	
<b>Impact on the ability of the District to comply with rules relating to historically underutilized businesses</b>	<b>0%</b>
<b>The Offeror's safety record</b>	<b>10%</b>
▪ <i>AIA A305 Exhibit C.3 Safety Program and Record</i>	
<b>The Offeror's proposed personnel and sub-offerors</b>	<b>20%</b>
▪ <i>AIA A305 Exhibit C.1 Performance of the Work</i>	
<b>Whether the Offeror's financial capability is appropriate to the size and scope of the project</b>	<b>10%</b>
▪ <i>AIA A305 Exhibit B – Financial and Performance Information</i>	
<b>Any other relevant factor specifically listed in the request for bids, proposals, or qualifications</b>	<b>0%</b>
<b>Total Weight</b>	<b>100%</b>

- B. The Selection Committee consisting of Galveston ISD administrators, architects, consultants and other staff will make an initial evaluation of the proposals. The committee's recommendation will be considered by the Galveston ISD Board of Trustees ("Board"). The District reserves the right to review the recommendation with others deemed appropriate by the District prior to review by the entire Board. The final decision-making authority on the proposals rests with the full Board. Decision-making authority has not been delegated to any person or entity other than the Board.
- C. The District will make such investigations as it deems necessary to determine the ability of the offeror to perform the Work, and the offeror shall furnish all such information and data for this purpose as may be requested. The District reserves the right to reject any proposal if the evidence submitted by, or investigation of, such offeror fails to satisfy the District that such offeror is properly qualified to carry out the obligations of the Contract and to complete the Work contemplated therein.
- D. The District reserves the right to reject any or all proposals and to waive any formalities or irregularities and to make the award of the contract in the best interest of the District.

- E. A decision regarding determination of the successful Offeror will be made by the District as soon as practical.

#### 1.11 EXECUTION OF CONTRACT

- A. The Owner reserves the right to accept any proposal, to reject any and all proposals, or to negotiate contract terms with the various proposers, when such is deemed by the Owner to be in their best interest.
- B. Notwithstanding delays in the preparation and execution of the formal contract agreement, each proposer shall be prepared, upon written notice of proposal acceptance, to commence work on or before a date stipulated in an official written order of the Owner to proceed.
- C. The accepted proposer shall assist and cooperate with the Owner in preparing the formal contract agreement, and within 5 days following its presentation shall execute same and return it to the Owner.
- D. Form for the contract agreement will be AIA Document A101, Standard Form of Agreement Between Owner and Contractor, Stipulated Sum, 2017 Edition.
- E. Proposals shall be submitted on unaltered proposal forms furnished by the Architect. Fill in blank spaces. If there are entries (blank spaces) on the proposal form which do not apply to a particular proposer, these entries shall be marked "N.A." (Not Applicable) by that proposer. No proposals will be considered that are amended or are qualified with conditional clauses, alterations, items not called for in the proposal, or irregularities which, in the Owner's opinion, may disqualify the proposer.

#### 1.12 TIME OF COMPLETION AND LIQUIDATED DAMAGES

- A. The contract date will be established as the number of consecutive calendar days as set out on the proposal form from the "Notice-to-proceed" date issued by the Owner.
- B. Failure of the Contractor to complete the Work by the contract date will result in damages being sustained by the Owner. Such damages are, and will continue to be, impracticable and extremely difficult to determine. Due consideration will be given to delays falling within 8.3 of the General Conditions.
- C. The Contractor will pay the Owner the amount indicated on the Proposal Form and in the General Conditions for each calendar day of delay in finishing the Work in excess of time specified for completion, plus authorized time extensions. Execution of the Contract under these specifications shall constitute agreement by the Owner and Contractor that the amount indicated is the minimum value of the costs and actual damage caused by failure of the Contractor to Substantially Complete the Work within the allotted time, that such sum is Liquidated Damages and shall not be construed as a penalty, and that such sum may be deducted from payments due the Contractor if such delay occurs.

#### 1.13 SALES TAX EXEMPTION

- A. The Owner qualifies for exemption from State and Local Sales Taxes pursuant to the provisions of the state of Texas Tax Code.

END OF DOCUMENT

DOCUMENT 00 42 00

PROPOSAL FORM

CENTRAL MIDDLE SCHOOL RENOVATIONS  
GALVESTON INDEPENDENT SCHOOL DISTRICT  
GALVESTON, TEXAS

PROPOSAL OF: \_\_\_\_\_  
(Name) (Date)

TO: Gwynetheia Shabazz Pope, Purchasing Coordinator  
Galveston Independent School District  
3904 Avenue T  
Galveston, TX 77550

Having examined the drawings, project manual, and related documents and having inspected the site of proposed Work, I (we) agree to furnish all labor, materials, and to perform all work described in the specifications and shown on the drawings for the sum of:

**BASE PROPOSAL:** For complete construction, including General, Mechanical, Plumbing, and Electrical Work, for the sum of:  
\_\_\_\_\_ DOLLARS  
(\$\_\_\_\_\_).

**ALLOWANCES:** The above base proposal includes all allowances listed in SECTION 01 21 00 – ALLOWANCES. Undersigned agrees that unexpended balance of allowance sums will revert to Owner in the final settlement of the contract.

**ALTERNATES:**  
Alternate No. 1: For providing the scope of work indicated on the drawings for the STEM SUITE, add to the base proposal the sum of:  
\_\_\_\_\_ DOLLARS  
(\$\_\_\_\_\_)

NOTE: Amounts shall be shown in both words and figures. In case of discrepancy, the amount shown in words shall govern.

I (we) acknowledge receipt of the following addenda:

Addendum No. 1 Dated _____	Addendum No. 4 Dated _____
Addendum No. 2 Dated _____	Addendum No. 5 Dated _____
Addendum No. 3 Dated _____	Addendum No. 6 Dated _____

**CONTRACT TIME:** The undersigned agrees, if this proposal is accepted, to begin Work on Notice to Proceed and be Substantially Complete by the following dates:

1. Phase I: August 1, 2022
2. Phase II: February 27, 2023

**PROPOSED SUBCONTRACTORS:**

Casework/Millwork: \_\_\_\_\_

Ceramic Tile: \_\_\_\_\_

Concrete: \_\_\_\_\_

Doors/Hardware: \_\_\_\_\_

Drywall: \_\_\_\_\_

Electrical: \_\_\_\_\_

Fire Alarm: \_\_\_\_\_

Fire Sprinkler: \_\_\_\_\_

Flooring: \_\_\_\_\_

Glazing: \_\_\_\_\_

Masonry: \_\_\_\_\_

Mechanical: \_\_\_\_\_

Painting: \_\_\_\_\_

Plumbing: \_\_\_\_\_

Storefront/Curtainwall: \_\_\_\_\_

Toilet Partitions/Accessories: \_\_\_\_\_



Upon receipt of notice of acceptance of this proposal within 30 days after the opening of proposals, I (we) agree to execute formal contract forms, acceptable surety bonds, and required insurance certificates within five days of receipt of the Contract.

Should I (we) fail to execute and deliver the Contract, along with the satisfactory surety bonds and insurance certification within the time set forth, the proposal security, attached hereto without endorsement, in the sum of:

\_\_\_\_\_ DOLLARS(\$\_\_\_\_\_).

shall become the property of Galveston Independent School District as liquidated damages for the delay caused and the additional work required.

\_\_\_\_\_  
Respectfully submitted, (Signature)

\_\_\_\_\_  
By (Please Print or Type)

\_\_\_\_\_  
Title

\_\_\_\_\_  
Contractor

\_\_\_\_\_  
Business Address

\_\_\_\_\_  
Telephone Number

\_\_\_\_\_  
FAX Number

ATTEST:

Indicate whether - Individual  
Partnership  
Corporation

\_\_\_\_\_  
Secretary

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DOCUMENT 00 45 18

CERTIFICATION OF PROHIBITED CONTRACTS WITH CERTAIN COMPANIES AND NOT BOYCOTT ISRAEL

**Prohibited Contracts with Certain Companies**

A Governmental entity may not enter into a Governmental contract with a company that is identified on a list prepared and maintained under Section 806.051, 807.051, or 2252.153. Sec. 2252.153. The comptroller shall prepare and maintain, and make available to each governmental entity, a list of companies known to have contracts with or provide supplies or services to a foreign terrorist organization. Contracts companies engaged in business with Iran, Sudan, or foreign terrorist organization is prohibited.

**Not Boycott Israel**

Pursuant to Texas Government Code Chapter 2270: Section 2270.001 (Amended), Does not boycott Israel currently and will not boycott Israel during the term of any contract with Galveston ISD.

"Boycott Israel" means refusing to deal with, terminating business activities with, or otherwise taking any action that is intended to penalize, inflict economic harm on, or limit commercial relations specifically with Israel, or with a person or entity doing business in Israel or in an Israeli-controlled territory, but does not include an action made for ordinary business purposes.

"Company" means a for-profit organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or limited liability company, including a wholly owned subsidiary, majority-owned subsidiary, parent company, or affiliate of those entities or business associations that exists to make a profit which has ten (10) or more full-time employees and the value of the contract with Owner is \$100,000 or more.

NOTE: The U.S. District Court for the Western District of Texas entered a preliminary injunction enjoining the enforcement of the above clause in any state contract. Texas Government Code, Chapter 2270 has been amended since the date of the injunction and the requirement of the statute is included above in its amended form. As the statute may not cure the entire breadth of issues addressed by injunction, the Owner does not intend to seek enforcement of this statute until further order of this or higher court having jurisdiction over the issue.

I, \_\_\_\_\_ hereby certifies that \_\_\_\_\_ (Company Name) it is not a company identified on the Texas Comptroller's list of companies known to have contracts with, or provide supplies or services to, a foreign organization designated as a Foreign Terrorist Organization by the U.S. Secretary of State. I further certify that should the above-named company enter into a contract that is on said listing of companies on the website of the Comptroller of the State of Texas, I will immediately notify the Galveston Independent School District's Purchasing Department.

Proposer further certifies and verifies that neither Proposer, nor any affiliate, subsidiary, or parent company of Proposer, if any (the "Proposer Companies"), boycotts Israel and Proposer agrees that Proposer and Proposer Companies will not boycott Israel during the term of this Agreement.

Printed Name: \_\_\_\_\_ Position/Title: \_\_\_\_\_

Signature of Authorized Rep: \_\_\_\_\_ Date: \_\_\_\_\_

END OF DOCUMENT

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DOCUMENT 00 45 19

NON-COLLUSION AFFIDAVIT  
**CENTRAL MIDDLE SCHOOL RENOVATIONS**  
GALVESTON INDEPENDENT SCHOOL DISTRICT

By submission of this bid or proposal, the undersigned certifies that:

- A. The bid or proposal has been independently arrived at without collusion with any other bidder or with any other competitor;
- B. This bid or proposal has not been knowingly disclosed and will not be knowingly disclosed, to any other bidder or competitor or potential competitor, prior to the opening of the bids, or proposals for this project;
- C. No attempt has been or will be made to induce any other person, partnership or corporation to submit or not submit a bid or proposal;
- D. The undersigned certifies that he is fully informed regarding the accuracy of the statements contained in this certification, and that the penalties herein are applicable to the bidder as well as to any person signing in his behalf.

\_\_\_\_\_  
Authorized Agent (Print Name)

\_\_\_\_\_  
Date

\_\_\_\_\_  
Signature

\_\_\_\_\_  
Company Name

\_\_\_\_\_  
Company Address

\_\_\_\_\_  
City

\_\_\_\_\_  
State

\_\_\_\_\_  
Zip

END OF DOCUMENT

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DOCUMENT 00 45 20

FELONY CONVICTION NOTIFICATION

State of Texas Legislative Senate Bill No. 1, Section 44.034, Notification of Criminal History, Subsection (a) states "a person or business entity that enters into a contract with a school district must give advance notice to the district if the person or owner or operator of the business entity has been convicted of a felony." The notice must include a general description of the conduct resulting in the conviction of a felony.

Subsection (b) states "a school district may terminate a contract with a person or business entity if the district determines that the person or business entity failed to give notice as required by Subsection (a) or misrepresented the conduct resulting in the conviction. The district must compensate the person or business entity for services performed before the termination of the contract."

**This notice is not required of a publicly-held corporation.**

**Please complete the information below.**

I, the undersigned agent for the firm named below, certify that the information concerning notification of felony convictions has been reviewed by me and the following information furnished is true to the best of my knowledge.

Offeror's Name: \_\_\_\_\_

Name of Authorized Company Official (Please print or type):  
\_\_\_\_\_

A. My firm is a publicly-held corporation; therefore, this reporting requirement is not applicable.

Signature of Authorized Company Official: \_\_\_\_\_  
Date

B. My firm is not owned nor operated by anyone who has been convicted of felony.

Signature of Authorized Company Official: \_\_\_\_\_  
Date

C. My firm is owned or operated by the following individual(s) who has/have been convicted of a felony:

Name of Felon(s): \_\_\_\_\_  
\_\_\_\_\_

Details of Conviction(s): \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

Signature of Authorized Company Official: \_\_\_\_\_  
Date

END OF SECTION

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DOCUMENTS 00 45 25

CERTIFICATION OF CRIMINAL HISTORY RECORD INFORMATION  
REVIEW BY CONTRACTOR-EMPLOYER

**Certifying Affidavit submitted to:**

**Name of School District:** Galveston Independent School District

**Mailing Address:** 3904 Avenue T  
Galveston, TX 77550

**Project:** **Central Middle School Renovations**

STATE OF TEXAS §

COUNTY OF §

(1) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to Galveston Independent School District (the "District") that such firm has obtained, reviewed and verified, from a law enforcement or criminal justice agency or a private entity that is consumer reporting agency governed by the Fair Credit Reporting Act (15 U.S.C. §§ 1681 et seq.) the criminal history record information of all employees hired **before January 1, 2008**, who (a) have or will have continuing duties related to the contracted services, and (b) have or will be on school campuses. Such employees are identified by name on Schedule A attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule A have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(2) The undersigned representative, on behalf of the contracting firm identified below, swears and affirms to the District, that such firm has obtained, reviewed and verified, from the Texas Department of Public Safety criminal clearinghouse, the national criminal history record information of all employees hired **on or after January 1, 2008**, who (a) have or will have continuing duties related to the contracted services, and (b) be on school campuses. Such employees are identified by name on Schedule B attached hereto. The undersigned further swears and affirms no employees who meet the requirements of (a) and (b) herein and/or identified on Schedule B have been convicted of any offense identified in Section 22.085 of the Texas Education Code.

(3) The undersigned firm swears and covenants that no present or future employee will provide services to the Project that involve direct contact with students unless and until such employee's national criminal history record information has been reviewed and cleared as required by Paragraph (2) above, and an updated Certification has been submitted by the contracting firm to the District with an updated Schedule B identifying such employees. In the event of an emergency, an employee who has not been previously certified may only provide services that involve direct contact with students if such employee is escorted by a District representative.

(4) The undersigned firm swears and covenants that, upon receipt of information, directly or indirectly, that any employee of the contracting firm has been convicted of an offense identified in Section 22.085 of the Texas Education Code, the contracting firm will immediately remove such employee from the Project and notify the District.

(5) Furthermore, the name, driver's license number, date of birth, and any other information required by the DPS will be submitted to the District for any person on either Schedule A or Schedule B for the purposes of subscribing to and issuing a District badge.

\_\_\_\_\_, being duly sworn, affirms and certifies that he/she is the  
\_\_\_\_\_ (position) of \_\_\_\_\_ (contracting  
firm), and that all statements and acknowledgements contained herein are true and correct, and that  
he/she has the authority to bind such firm to the covenants set out above.

\_\_\_\_\_

SUBSCRIBED AND SWORN TO BEFORE ME this \_\_\_\_\_ day of \_\_\_\_\_, 20\_\_.

Notary Public \_\_\_\_\_

State of \_\_\_\_\_

My Commission Expires: \_\_\_\_\_

DOCUMENT 00 45 30

SB 13 AND SB 19 CERTIFICATION

**CERTIFICATION REGARDING BOYCOTTING CERTAIN ENERGY COMPANIES**

If (a) Provider is not a sole proprietorship; (b) Provider has ten (10) or more full-time employees; and (c) this Contract has a value of \$100,000 or more that is to be paid wholly or partly from public funds, the following certification shall apply; otherwise, this certification is not required. Pursuant to TEX. GOV'T CODE Ch. 2274 of SB 13 (87th session), the Provider hereby certifies and verifies that the Provider, or any wholly owned subsidiary, majority-owned subsidiary, parent company, or affiliate of these entities or business associations, if any, does not boycott energy companies and will not boycott energy companies during the term of the Contract. For purposes of this Addendum, the term "company" shall mean an organization, association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or limited liability company, which exists to make a profit. The term "boycott energy company" shall mean "without an ordinary business purpose, refusing to deal with, terminating business activities with, or otherwise taking any action intended to penalize, inflict economic harm on, or limit commercial relations with a company because the company (a) engages in the exploration, production, utilization, transportation, sale, or manufacturing of fossil fuel-based energy and does not commit or pledge to meet environmental standards beyond applicable federal and state law, or (b) does business with a company described by paragraph (a)." See TEX. GOV'T CODE § 809.001(1).

**CERTIFICATION PROHIBITING DISCRIMINATION AGAINST FIREARM AND AMMUNITION INDUSTRIES**

If (a) Provider is not a sole proprietorship; (b) Provider has at least ten (10) full-time employees; (c) this Contract has a value of at least \$100,000 that is paid wholly or partly from public funds; (d) the Contract is not excepted under TEX. GOV'T CODE § 2274.003 of SB 19 (87th leg.); and (e) governmental entity has determined that Provider is not a sole-source provider or GISD has not received any bids from a company that is able to provide this written verification, the following certification shall apply; otherwise, this certification is not required. Pursuant to TEX. GOV'T CODE Ch. 2274 of SB 19 (87th session), the Provider hereby certifies and verifies that the Provider, or association, corporation, partnership, joint venture, limited partnership, limited liability partnership, or limited liability company, including a wholly owned subsidiary, majority-owned subsidiary parent company, or affiliate of these entities or associations, that exists to make a profit, does not have a practice, policy, guidance, or directive that discriminates against a firearm entity or firearm trade association and will not discriminate during the term of this Agreement against a firearm entity or firearm trade association. For purposes of this Contract, "discriminate against a firearm entity or firearm trade association" shall mean, with respect to the entity or association, to: "(1) refuse to engage in the trade of any goods or services with the entity or association based solely on its status as a firearm entity or firearm trade association; (2) refrain from continuing an existing business relationship with the entity or association based solely on its status as a firearm entity or firearm trade association; or (3) terminate an existing business relationship with the entity or association based solely on its status as a firearm entity or firearm trade association. See TEX. GOV'T CODE § 2274.001(3) of SB 19. "Discrimination against a firearm entity or firearm trade association" does not include: "(1) the established policies of a merchant, retail seller, or platform that restrict or prohibit the listing or selling of ammunition, firearms, or firearm accessories; and (2) a company's refusal to engage in the trade of any goods or services, decision to refrain from continuing an existing business relationship, or decision to terminate an existing business relationship to comply with federal, state, or local law, policy, or regulations or a directive by a regulatory agency, or for any traditional business reason that is specific to the customer or potential customer and not based solely on an entity's or association's status as a firearm entity or firearm trade association." See TEX. GOV'T CODE § 2274.001(3) of SB 19.

**CERTIFICATION REGARDING CERTAIN FOREIGN-OWNED COMPANIES IN CONNECTION WITH CRITICAL INFRASTRUCTURE**

GISD is prohibited from entering into a contract or other agreement relating to critical infrastructure that would grant to the Provider direct or remote access to or control of critical infrastructure in this state, excluding access specifically allowed by the GISD for product warranty and support purposes. Provider, certifies that neither it nor its parent company nor any affiliate of Provider or its parent company, is (1) owned by or the majority of stock or other ownership interest of the company is held or controlled by individuals who are citizens of China, Iran, North Korea, Russia, or a designated country; (2) a company or other entity, including governmental entity, that is owned or controlled by citizens of or is directly controlled by the government of China, Iran, North Korea, Russia, or a designated country; or (3) headquartered in China, Iran, North Korea, Russia, or a designated country. For purposes of this Addendum, "critical infrastructure" means "a communication infrastructure system, cybersecurity system, electric grid, hazardous waste treatment system, or water treatment facility." See TEX. GOV'T CODE § 2274.0101(2) of SB 1226 (87th leg.). The Provider verifies and certifies that Provider will not grant direct or remote access to or control of critical infrastructure, except for product warranty and support purposes, to prohibited individuals, companies, or entities, including governmental entities, owned, controlled, or headquartered in China, Iran, North Korea, Russia, or a designated country, as determined by the Governor.

Central Middle School Renovations  
Galveston ISD  
Galveston, Texas

Contractor hereby certifies and verifies that Contractor, or any affiliate, subsidiary, or parent company of Contractor, if any (the "Contractor Companies"), will comply with the above certifications' during the terms of this Agreement.

Offeror's Name: \_\_\_\_\_

Name and Title of Authorized Company Official: \_\_\_\_\_

Signature of Authorized Company Official \_\_\_\_\_ Date \_\_\_\_\_

END OF DOCUMENT

DOCUMENT 00 45 35

CERTIFICATE OF RESIDENCY

Pursuant to Government Code, Chapter 2252, Subchapter A, makes it necessary for the District to determine the residency of its bidder. In part, this law reads as follows:

Section: 2252.001

(3) 'Non-resident' bidder refers to a person who is not a resident.

(4) 'Resident bidder' refers to a person whose principal place of business is in this state, including a contractor whose ultimate parent company or majority owner has its principal place of business in this state.

Section: 2252.002

A governmental entity may not award a government contract to a nonresident bidder unless the nonresident underbids the lowest proposal submitted by a responsible resident bidder by an amount that is not less than the amount by which a resident bidder would be required to underbid the nonresident bidder to obtain a comparable contract in the state in which the nonresident's principal place of business is located."

"Resident proposer" refers to a person whose principal place of business is in this state, including a proposer whose ultimate parent company or majority owner has its principal place of business in this state.

"Nonresident proposer" refers to a person who is not a resident.

"Resident state" means the state in which the principle place of business is located.

☐ My company is a "resident proposer"

☐ My company is a "nonresident proposer" of \_\_\_\_\_ (the state your principal place of business is located)

Does your "resident state" require proposer whose principle place of business is in Texas to under Proposal, proposers whose resident state is the same as yours by a prescribed amount or percentage to receive a comparable contract?

☐ No      ☐ Yes      If yes, what is the amount or percentage? \_\_\_\_\_

Printed Name: \_\_\_\_\_ Position/Title: \_\_\_\_\_

Signature of Authorized Rep: \_\_\_\_\_ Date: \_\_\_\_\_

END OF DOCUMENT

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DOCUMENT 00 45 46

CONFLICT OF INTEREST QUESTIONNAIRE  
for vendor or other person doing business with local governmental entity

The attached questionnaire is being filed in accordance with chapter 176 of the Local Government Code by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

This questionnaire reflects changes made to the law by H.B. 23, 84<sup>th</sup> Leg., Regular Session, which became effective September 1, 2015. This form was adopted by the Texas Ethics Commission, November 30, 2015.

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# CONFLICT OF INTEREST QUESTIONNAIRE

FORM CIQ

For vendor doing business with local governmental entity

**This questionnaire reflects changes made to the law by H.B. 23, 84th Leg., Regular Session.**

This questionnaire is being filed in accordance with Chapter 176, Local Government Code, by a vendor who has a business relationship as defined by Section 176.001(1-a) with a local governmental entity and the vendor meets requirements under Section 176.006(a).

By law this questionnaire must be filed with the records administrator of the local governmental entity not later than the 7th business day after the date the vendor becomes aware of facts that require the statement to be filed. See Section 176.006(a-1), Local Government Code.

A vendor commits an offense if the vendor knowingly violates Section 176.006, Local Government Code. An offense under this section is a misdemeanor.

## OFFICE USE ONLY

Date Received

**1 Name of vendor who has a business relationship with local governmental entity.**

**2** ☐ **Check this box if you are filing an update to a previously filed questionnaire.** (The law requires that you file an updated completed questionnaire with the appropriate filing authority not later than the 7th business day after the date on which you became aware that the originally filed questionnaire was incomplete or inaccurate.)

**3 Name of local government officer about whom the information is being disclosed.**

\_\_\_\_\_  
Name of Officer

**4 Describe each employment or other business relationship with the local government officer, or a family member of the officer, as described by Section 176.003(a)(2)(A). Also describe any family relationship with the local government officer. Complete subparts A and B for each employment or business relationship described. Attach additional pages to this Form CIQ as necessary.**

A. Is the local government officer or a family member of the officer receiving or likely to receive taxable income, other than investment income, from the vendor?

☐ Yes ☐ No

B. Is the vendor receiving or likely to receive taxable income, other than investment income, from or at the direction of the local government officer or a family member of the officer AND the taxable income is not received from the local governmental entity?

☐ Yes ☐ No

**5 Describe each employment or business relationship that the vendor named in Section 1 maintains with a corporation or other business entity with respect to which the local government officer serves as an officer or director, or holds an ownership interest of one percent or more.**

**6** ☐ Check this box if the vendor has given the local government officer or a family member of the officer one or more gifts as described in Section 176.003(a)(2)(B), excluding gifts described in Section 176.003(a-1).

**7**

\_\_\_\_\_  
Signature of vendor doing business with the governmental entity

\_\_\_\_\_  
Date

## **CONFLICT OF INTEREST QUESTIONNAIRE**

### **For vendor doing business with local governmental entity**

A complete copy of Chapter 176 of the Local Government Code may be found at <http://www.statutes.legis.state.tx.us/Docs/LG/htm/LG.176.htm>. For easy reference, below are some of the sections cited on this form.

**Local Government Code § 176.001(1-a):** "Business relationship" means a connection between two or more parties based on commercial activity of one of the parties. The term does not include a connection based on:

- (A) a transaction that is subject to rate or fee regulation by a federal, state, or local governmental entity or an agency of a federal, state, or local governmental entity;
- (B) a transaction conducted at a price and subject to terms available to the public; or
- (C) a purchase or lease of goods or services from a person that is chartered by a state or federal agency and that is subject to regular examination by, and reporting to, that agency.

**Local Government Code § 176.003(a)(2)(A) and (B):**

- (a) A local government officer shall file a conflicts disclosure statement with respect to a vendor if:

\*\*\*

- (2) the vendor:

(A) has an employment or other business relationship with the local government officer or a family member of the officer that results in the officer or family member receiving taxable income, other than investment income, that exceeds \$2,500 during the 12-month period preceding the date that the officer becomes aware that

(i) a contract between the local governmental entity and vendor has been executed;  
or

(ii) the local governmental entity is considering entering into a contract with the vendor;

(B) has given to the local government officer or a family member of the officer one or more gifts that have an aggregate value of more than \$100 in the 12-month period preceding the date the officer becomes aware that:

- (i) a contract between the local governmental entity and vendor has been executed; or
- (ii) the local governmental entity is considering entering into a contract with the vendor.

**Local Government Code § 176.006(a) and (a-1)**

- (a) A vendor shall file a completed conflict of interest questionnaire if the vendor has a business relationship with a local governmental entity and:

(1) has an employment or other business relationship with a local government officer of that local governmental entity, or a family member of the officer, described by Section 176.003(a)(2)(A);

(2) has given a local government officer of that local governmental entity, or a family member of the officer, one or more gifts with the aggregate value specified by Section 176.003(a)(2)(B), excluding any gift described by Section 176.003(a-1); or

(3) has a family relationship with a local government officer of that local governmental entity.

- (a-1) The completed conflict of interest questionnaire must be filed with the appropriate records administrator not later than the seventh business day after the later of:

- (1) the date that the vendor:

(A) begins discussions or negotiations to enter into a contract with the local governmental entity; or

(B) submits to the local governmental entity an application, response to a request for proposals or bids, correspondence, or another writing related to a potential contract with the local governmental entity; or

- (2) the date the vendor becomes aware:

(A) of an employment or other business relationship with a local government officer, or a family member of the officer, described by Subsection (a);

(B) that the vendor has given one or more gifts described by Subsection (a); or

(C) of a family relationship with a local government officer.

DOCUMENT 00 61 13.13

PERFORMANCE BOND FORM

Bond No.: \_\_\_\_\_

(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: \_\_\_\_\_  
(hereinafter called the Principal), as principal, and  
a corporation organized and existing under the laws of the State of \_\_\_\_\_ authorized and  
admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety  
(hereinafter called the Surety), as Surety, are held and firmly bound unto

\_\_\_\_\_

(hereinafter called the Obligee) in the amount of \_\_\_\_\_

\_\_\_\_\_

Dollars(\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves, and  
their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligee, dated this \_\_\_\_\_ day  
of \_\_\_\_\_, \_\_\_\_\_.

CENTRAL MIDDLE SCHOOL RENOVATIONS  
GALVESTON ISD  
GALVESTON, TEXAS

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall faithfully  
perform the work in accordance with the plans, specifications and contract documents, then this obligation shall be  
void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas  
Government Code and all liabilities on this bond shall be determined in accordance with the provisions of said  
Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this \_\_\_\_\_  
day of \_\_\_\_\_, \_\_\_\_\_.

(Seal) \_\_\_\_\_  
Principal

\_\_\_\_\_  
Surety Address By: \_\_\_\_\_

\_\_\_\_\_  
Surety Telephone Number \_\_\_\_\_  
Surety (Seal)

By: \_\_\_\_\_  
Attorney-in-Fact

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DOCUMENT 00 61 13.16

PAYMENT BOND FORM

Bond No.: \_\_\_\_\_

(Penalty of this bond must be 100% of contract amount)

KNOW ALL MEN BY THESE PRESENTS, that: \_\_\_\_\_  
(hereinafter called the Principal), as principal,  
a corporation organized and existing under the laws of the State of \_\_\_\_\_ authorized and  
admitted to do business in the State of Texas and licensed by the State of Texas to execute bonds as Surety  
(hereinafter called the Surety), as Surety, are held and firmly bound unto

\_\_\_\_\_

(hereinafter called the Obligor) in the amount of \_\_\_\_\_

\_\_\_\_\_

Dollars(\$ \_\_\_\_\_) for the payment whereof, the said Principal and Surety bind themselves, and  
their heirs, administrators, executors, successors and assigns, jointly and severally, firmly by these presents.

WHEREAS, the Principal has entered into a certain written contract with the Obligor, dated this \_\_\_\_\_ day  
of \_\_\_\_\_, \_\_\_\_\_.

CENTRAL MIDDLE SCHOOL RENOVATIONS  
GALVESTON ISD  
GALVESTON, TEXAS

which contract is hereby referred to and made a part hereof as fully and the same extent as if copied at length herein.

NOW, THEREFORE, THE CONDITION OF THIS OBLIGATION IS SUCH, that if the said Principal shall pay all  
claimants supplying labor and material to him or a Subcontractor in the prosecution of the work provided for in said  
contract, then this obligation shall be void; otherwise to remain in full force and effect.

PROVIDED, HOWEVER, that this bond is executed pursuant to the provisions of Chapter 22.53 of the Texas  
Government Code and all liabilities on this bond to all such claimants shall be determined in accordance with the  
provisions of said Chapter to the same extent as if it were copied at length herein.

IN WITNESS WHEREOF, the said Principal and Surety have signed and sealed this Instrument this \_\_\_\_\_  
day of \_\_\_\_\_, \_\_\_\_\_.

Witness: \_\_\_\_\_ (Seal)  
Principal

\_\_\_\_\_ By: \_\_\_\_\_

Witness:  
(Seal) \_\_\_\_\_  
Surety

\_\_\_\_\_ By: \_\_\_\_\_  
Attorney-in-Fact

\_\_\_\_\_ Surety Address \_\_\_\_\_ Surety Telephone Number

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**DOCUMENT 00 65 00**  
**RELEASE OF LIEN DOCUMENTS**

**APPENDIX INDEX:**

1. **CONDITIONAL WAIVER FOR PROGRESS PAYMENTS**
2. **UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS**
3. **CONDITIONAL WAIVER FOR FINAL PAYMENT**
4. **UNCONDITIONAL WAIVER FOR FINAL PAYMENT**

[Note: the attached forms are duplicated *verbatim* (without editing) from HB 1456.]





**FORM 2: UNCONDITIONAL WAIVER FOR PROGRESS PAYMENTS**

\* \* \* \* \*

NOTICE: THIS DOCUMENT WAIVES RIGHTS UNCONDITIONALLY AND STATES THAT YOU HAVE BEEN PAID FOR GIVING UP THOSE RIGHTS. IT IS PROHIBITED FOR A PERSON TO REQUIRE YOU TO SIGN THIS DOCUMENT IF YOU HAVE NOT BEEN PAID THE PAYMENT AMOUNT SET FORTH BELOW. IF YOU HAVE NOT BEEN PAID, USE A CONDITIONAL RELEASE FORM.

**UNCONDITIONAL WAIVER AND RELEASE ON PROGRESS PAYMENT**

Project: \_\_\_\_\_

Job No.: \_\_\_\_\_

The signer of this document has been paid and has received a progress payment in the sum of \$ \_\_\_\_\_ for all labor, services, equipment, or materials furnished to the property or to \_\_\_\_\_ (person with whom signer contracted) on the property of \_\_\_\_\_ (owner) located at \_\_\_\_\_ (location) to the following extent: \_\_\_\_\_

\_\_\_\_\_  
(job description). The signer therefore waives and releases any mechanic's lien right, any right arising from a payment bond that complies with a state or federal statute, any common law payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to claim or payment rights for persons in the signer's position that the signer has on the above referenced project to the following extent: \_\_\_\_\_

\_\_\_\_\_  
This release covers a progress payment for all labor, services, equipment, or materials furnished to the property or to \_\_\_\_\_ (person with whom signer contracted) as indicated in the attached statement(s) or progress payment request(s), except for unpaid retention, pending modifications and changes, or other items furnished.

The signer warrants that the signer has already paid or will use the funds received from this progress payment to promptly pay in **full** all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials, equipment, or services provided for or to the above referenced project in regard to the attached statement(s) or progress payment request(s).

Date: \_\_\_\_\_

\_\_\_\_\_  
(Company name)

By \_\_\_\_\_ (Signature)

\_\_\_\_\_  
(Title)

**FORM 3: CONDITIONAL WAIVER FOR FINAL PAYMENT**

\* \* \* \* \*

**CONDITIONAL WAIVER AND RELEASE ON FINAL PAYMENT**

Project: \_\_\_\_\_

Job No.: \_\_\_\_\_

On receipt by the signer of this document of a check from \_\_\_\_\_

\_\_\_\_\_ (maker of check) in the sum of  
\$ \_\_\_\_\_ payable to

\_\_\_\_\_ (payee or payees of check) and when the check has been properly endorsed and  
has been paid by the bank on which it is drawn, this document becomes effective to release any mechanic's lien  
right, any right arising from a payment bond that complies with a state or federal statute, any common law  
payment bond right, any claim for payment, and any rights under any similar ordinance, rule, or statute related to  
claim or payment rights for persons in the signer's position that the signer has on the property of \_\_\_\_\_

\_\_\_\_\_ (owner) located at \_\_\_\_\_

\_\_\_\_\_ (location) to the following extent: \_\_\_\_\_

\_\_\_\_\_ (job description).

This release covers the final payment to the signer for all labor, services, equipment, or materials furnished to  
the property or to \_\_\_\_\_  
(person with whom signer contracted).

Before any recipient of this document relies on this document, the recipient should verify evidence of payment to the  
signer.

The signer warrants that the signer has already paid or will use the funds received from this final payment to  
promptly pay in full all of the signer's laborers, subcontractors, materialmen, and suppliers for all work, materials,  
equipment, or services provided for or to the above referenced project up to the date of this waiver and release.

Date: \_\_\_\_\_

\_\_\_\_\_ (Company name)

By \_\_\_\_\_ (Signature)

\_\_\_\_\_ (Title)



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SECTION 01 11 00

SUMMARY OF WORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Related Documents/Sections
  - 1. Section 01 45 00 - Testing and Inspecting Services.
  - 2. Section 01 50 00 - Temporary Facilities and Controls.

1.2 DESCRIPTION

- A. The Work comprises the construction of Central Middle School Renovations for Galveston Independent School District, Galveston, Texas, as shown on the drawings and described in the Project Manual. The work shall be done under one lump sum contract.
- B. Indication on the drawings or mention in the specifications of articles, materials, operations or methods requires that the Contractor provide each item indicated or mentioned of the quality or subject to the qualifications noted, and perform according to the conditions stated each operation described and provide therefor all necessary labor, equipment, services and incidentals.
  - 1. All subcontractors are responsible for examining the architectural drawings for structural, mechanical, electrical, and plumbing items. Any items shown on these drawings shall be furnished by the appropriate subcontractor.

1.3 DEFINITIONS

- A. Addenda are written or graphic instruments issued prior to the execution of the Contract which modify or interpret the bidding documents, including Drawings and Specifications, by additions, deletions, clarifications or corrections. Addenda will become part of the Contract Documents when the Construction Contract is executed.
- B. "VLK Architects, Inc." will be hereafter referred to in this Project Manual as "Architect" and all correspondence shall be addressed to: 20445 SH 249, Suite 350, Houston, Texas 77070.
- C. "Galveston ISD" will be hereafter referred to in this Project Manual as "Owner".
- D. Suppliers and Subcontractors will be hereafter referred to in the Construction Documents as "Contractor", "Subcontractor", "Supplier", "Proposer", or "Offerer".
- E. Additional Definitions: Reference DOCUMENT 00 70 00 - GENERAL CONDITIONS OF THE CONTRACT FOR CONSTRUCTION, AIA DOCUMENT A201-2017.

1.4 CONDITIONS OF THE CONTRACT

- A. The General Conditions of the Contract for Construction, AIA Document A201-2017, bound herewith as preceding portions of these specifications, form a part thereof and shall govern the work under each section.

1.5 EXISTING SITE CONDITIONS

- A. The Contractor shall visit and examine the site. Upon award of the Contract, the Contractor shall accept the condition of the site before beginning the work required.

1.6 SPECIAL REQUIREMENTS

- A. Contractor shall be required to use the project management website system (Projectmates) at [www.vlkprojects.com](http://www.vlkprojects.com) during the Construction Phase of this project. All Submittals, RFI's, ASI's, and other construction documents shall be submitted and managed through this website based system.
- B. The present building houses an operating facility that must continue in operation during the construction period, except as the Architect and Owner may otherwise direct. Plumbing, heating, ventilating, electrical

and telephone systems shall continue to function with a minimum of interruptions in service. Do not block required fire exits.

- C. Contractor shall assume responsibility for the protection of all areas of work and shall provide and maintain all protections required. Protect existing surfaces of the building and equipment, both interior and exterior, as required during the construction period. Provide necessary dust screens, drop cloths and temporary walls and/or coverings as may be required for protection. Existing surfaces that are damaged due to construction shall be patched or replaced to original condition.
- D. Galveston ISD shall be notified by Contractor of all cover-up inspections date and time. The school district shall be in attendance at each inspection.
- E. Where designated on the drawings, salvage, relocate and reinstall certain items. Existing items so designated shall be properly installed, securely fastened as required, set plumb and level and left complete and operational. Exercise extensive care in relocating such items so as to prevent damage. Other existing building materials indicated to be removed or demolished, unless noted otherwise or claimed by the Owner shall become property of the Contractor and shall be removed from the site immediately.
- F. Wherever exterior walls are to be demolished or existing doors replaced, the exposed portion of the existing building shall be protected by the Contractor against the elements, construction debris and intrusion by unauthorized persons, by means subject to approval of the Architect.
- G. Execute Certificate of Substantial Completion for each designated portion of work prior to Owner occupancy. Following execution of a Substantial Completion Certificate for a designated portion of the work, the Contractor shall permit:
  - 1. Access for Owner personnel.
  - 2. Use of parking facilities for the benefit of the Owner.
  - 3. Operation of HVAC and electrical systems for the benefit of the Owner.
- H. Despite partial Owner occupancy, the Contractor shall remain responsible for all portions of the work which have not attained Substantial Completion and for which a Substantial Completion Certificate, which shall designate the date on which the Owner shall become responsible for utilities, maintenance, security, damage to the work and insurance, has not been executed.
- I. The loop fire lane and fire hydrants are required by the City to be operational during construction.

#### 1.7 CONTRACTOR USE OF PREMISES

- A. Limit use of premises for work, for storage and for access, to allow for Owner occupancy.
- B. Coordinate use of premises under direction of Owner.
- C. Assume full responsibility for protection and safekeeping of products under this Contract.
- D. Obtain and pay for use of additional storage or work areas needed when required for operations under this Contract.
- E. During construction the Owner will continue to perform normal activities in and around the adjacent existing building. Proper and safe access to the Owner-occupied areas shall be maintained. **Interruption of mechanical and electrical services to the building shall be only at such times and for lengths of time as approved by the Owner.**
- F. There shall be no storage of materials or equipment in the occupied portions of the existing building. There shall be no fires on the site or in the building. There shall be no dumping on Owner's property.

- G. Worker Identity Badging Requirements: Provide construction personnel (including subcontractors and suppliers regularly visiting the project site) with identification badges, with photograph. Identification badges shall be worn visibly by construction personnel on the construction site or on Owner's property. NO EMPLOYEE WILL BE PERMITTED ON SITE WITHOUT THIS BADGE DISPLAYED ON THE EMPLOYEE. Contractor must assure that the Crisis Management contact information is provided on the reverse side of each worker's badge. Temporary or visitor badges will be provided for persons who are identified as having an infrequent or temporary legitimate business need for access to the site.

#### 1.8 WORK BY OWNER AND UNDER SEPARATE CONTRACTS

- A. Cooperate fully with Owner so Work may be carried out smoothly, without interfering with or delaying the work or work by Owner. Coordinate the Work with Work performed by Owner.
- B. The Owner reserves the right to let separate contract for Work outside of the scope of this Contract. Cooperate fully with separate contractors so Work on those contracts may be carried out smoothly, without interfering with or delaying Work under this Contract or other contracts. Coordinate the Work of this Contract with Work performed under separate contracts.
- C. Purchase Contracts: The Owner reserves the right to negotiate purchase contracts with suppliers of material and equipment that may be incorporated into the Work. The Owner will assign these purchase contracts to Contractor. Include costs for purchasing, receiving, handling, storage if required, and installation of material and equipment in the Contract Sum, unless otherwise indicated.
  - 1. Contractor's responsibilities are same as if Contractor had negotiated purchase contracts, including responsibility to renegotiate purchase and to execute final purchasing agreements.
- D. Owner Furnished, Contractor Installed Products (OFCI): The Owner will furnish products indicated. The Work includes receiving, unloading, handling, storing, protecting, and installing Owner furnished products and making building services connections when applicable.
  - 1. Owner Furnished Products: Coordinate with Owner.

#### 1.9 WORK RESTRICTIONS

- A. On-Site Work Hours: Work shall be generally performed on the project site during normal business working hours, Monday through Friday, or City ordinance whichever is more restrictive.
- B. Early Morning Hours: Comply with City noise ordinances for restriction of early-morning concrete pours and other noisy construction activities. Owner's testing laboratory personnel will be available only during on-site work hours listed above.
- C. Work Restrictions within Existing Building(s): Work shall be generally performed inside the existing building during the summer break and after normal school classes Monday through Friday. During student holidays when the faculty and staff may be on campus, extent of work and utility interruption shall be coordinated with the Owner in advance. On dates designated as STAAR testing days, work within the existing building is not allowed and work in other areas may need to be limited to keeping down the amount of noise and distraction for the students. Work on these days shall be coordinated with the Owner in advance.

#### 1.10 COORDINATION

- A. Drawing details and other sections of these specifications covering work connected with or relating to that specified under a specific heading shall be examined for conditions which may affect that part of the work. Failure to do so will not relieve those furnishing materials and/or labor under a specification heading from supplying materials or performing work reasonably necessary to properly coordinate their work with that of other trades.
- B. The Contractor shall produce and submit for review, composite coordination drawings within four (4) weeks of the Contractor's receipt of a Notice to Proceed on the Project. The composite coordination drawings shall depict the coordination of all structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security and CCTV systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping in a composite above ceiling plan, composite below slab plan, and a composite mechanical and electrical equipment room floor plan. Plans shall be produced at a scale of one-quarter (1/4") per foot and shall include larger scale sections with vertical elevations of elements required to confirm coordination of all elements. A schedule value for the production of the composite coordination

drawings shall be included in the Continuation Sheet of the Application and Certificate for Payment for each of the Divisions of trade.

#### 1.11 LAYING OUT WORK, MEASUREMENTS

- A. Verify all measurements at the building. No extra compensation will be allowed for differences between actual dimensions and dimensions indicated on the drawings. In all cases, figured dimensions and measurements taken at the site shall take precedence over scaled dimensions.

#### 1.12 DISCREPANCIES

- A. In case of discrepancies within the drawings, within the specifications, or between the drawings and specifications, the better quality and greater quantity, in the opinion of the Architect, shall be furnished and installed.

#### 1.13 PROTECTION

- A. General: Limit use of the premises to construction activities in areas indicated; allow for Owner occupancy in adjacent spaces and around the site.
  - 1. Confine operations to areas within Contract limits indicated. Portions of the building which are outside the areas construction operations are indicated, are not to be disturbed.
  - 2. Keep driveways and entrances serving the premises clear and available to the Owner and the Owner's employees. Do not use these areas for parking or storage of materials without prior approval. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on site.
  - 3. Do not dispose of organic and hazardous material on site, either by burial or by burning. All disposable material and trash must be removed properly.
- B. Contractor shall take over and assume responsibility for the premises and shall provide and maintain all protections required by the governing laws, regulations and ordinances. The Contractor shall be responsible for any loss or damage caused by him or his workmen to the property of the Owner or to the work or materials installed, and shall make good any loss, damage or injury without cost to the Owner.
- C. The protection of adjacent property shall include but will not necessarily be limited to the erection and maintenance of shoring, underpinning and fences as necessary to protect and support existing work to be left in place.
- D. Finished floors shall be protected against damage by workmen and equipment during the work. Where materials are carried into the building, the building floors shall be covered to protect the work against dirt or grit being ground in.
- E. Where existing roofing, flashing, exterior walls, doors and windows are removed, the openings and exposed portions of the construction shall be covered and protected so as to be weathertight until new work is in place.
- F. Where work is being done on the existing building, the furniture, fixtures and equipment in the building shall be covered with heavy plastic sheeting or clean tarpaulins to protect the property against damage and stains. The furniture and equipment shall not be removed from the building.
- G. Trees and shrubs on the site which do not have to be removed for the new work shall be protected against damage. No Contractor shall remove or trim any trees and shrubs in the area without the express approval of the Architect.
- H. Contractor shall send proper notices, make necessary arrangements and perform other services required for the care, protection and maintenance of Public Utilities, including fire plugs and wires and all other items of this character on and around the building site.
- I. Contractor shall maintain accessible all building exits required by the City during all phases of construction. Protection of these exits shall include dust-proof enclosures, illumination and exit lighting required.
- J. While school is in session, provide appropriate measures to control the migration of dust and odors into occupied areas of the school.



#### 1.14 CUTTING AND PATCHING

- A. Cutting and chasing of existing construction for relocation of mechanical and electrical work and for installation of pipes and ducts will be done by the trades concerned. Patching and finishing shall be done by the Contractor. This work shall be done with proper tools and by careful workmen of the particular trade to which such work belongs and shall be done without extra cost to the Owner.

#### 1.15 RECORD DRAWINGS

- A. Contractor shall maintain a complete clean set of Drawings and Project Manual in the project field office for the sole purpose of recording "installed" conditions. Installed conditions shall include addendum items, change orders, or any other items which come up during the construction phase which deviate from the Construction Documents. Changes made in these drawings and Project Manual in connection with the final construction and installation shall be neatly made in red ink. Upon completion of the project, the marked set of Drawings and Project Manual shall be delivered to the Architect for subsequent transmittal to the Owner. These drawings shall be maintained to reflect the current conditions of the work and changes shall be reviewed on a monthly basis with the Architect's representative. The Contractor's updating of the "installed" condition Drawings and Project Manual shall be a prerequisite to the monthly review of the Contractor's payment request by the Architect's representative.

#### 1.16 INSTRUCTIONS CONCERNING ASBESTOS

- A. In the event the Contractor encounters on the site material reasonably believed to be asbestos which has not been rendered harmless, the Contractor shall immediately stop work in the area affected and report the condition to the Owner in writing. If, in fact the material is asbestos and has not been rendered harmless, the work in the affected area shall not thereafter be resumed until the asbestos has been removed or rendered harmless by the Owner. The work in the affected area shall be resumed in the absence of asbestos, or when it has been rendered harmless, by written agreement of the Owner and Contractor.
- B. The Contractor shall not be required to perform without consent any work relating to asbestos.

### PART 2 - PRODUCTS

Not used

### PART 3 - EXECUTION

#### 3.1 CONSTRUCTION SCHEDULE – PHASED CONSTRUCTION

- A. General: On-site work cannot interrupt school activities.
- B. The Owner has a critical need for the Work to begin upon Notice to Proceed and shall be Substantially Complete by:
  - 1. Phase I – All scope of work with exception of scope identified within Phase II.
    - a. Commence on-site work: upon Notice to Proceed for Life Skills/ SPED area. All other portions of the building for this phase shall commence on-site work on June 1, 2022.
    - b. Substantial Completion: August 1, 2022
  - 2. Phase II – STEM Suite (alternate proposal): Renovations to create a STEM Suite (STEM lab and classroom). Scope includes, but is not limited to, mechanical, electrical, and structural updates, interior and exterior glazing, and finish upgrades.
    - a. Commence on-site work: upon receipt of Notice to Proceed
    - b. Substantial Completion: February 27, 2023

END OF SECTION

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**SECTION 01 20 00**

**PRICE AND PAYMENT PROCEDURES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Procedures for preparation and submittal of applications for progress payments.
- B. Documentation of changes in Contract Sum and Contract Time.
- C. Change procedures.
- D. Correlation of Contractor submittals based on changes.
- E. Procedures for preparation and submittal of application for final payment.

**1.2 RELATED REQUIREMENTS**

- A. Section 01 77 00 - Closeout Procedures.
- B. Section 01 77 10 - Closeout Procedures Form
- C. Section 01 77 22 - Substantial Completion Procedures
- D. Section 01 78 39 - Project Record Documents
- E. Section 01 88 13 - Special Construction Performance Requirements

**1.3 SCHEDULE OF VALUES**

- A. Use Schedule of Values Form: AIA G703, edition stipulated in the Agreement.
- B. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit draft to Architect for approval.
- C. Forms filled out by hand will not be accepted.
- D. Submit Schedule of Values to Architect by E-Mail within 15 days after date of Owner-Contractor Agreement.
- E. Format: Utilize the Table of Contents of this Project Manual. Identify each line item with number and title of the specification section. Identify site mobilization and bonds and insurance.
- F. Include separately from each line item, a direct proportional amount of Contractor's overhead and profit.
- G. Revise schedule to list approved Change Orders, with each Application For Payment.

**1.4 APPLICATIONS FOR PROGRESS PAYMENTS**

- A. Payment Period: Submit at intervals stipulated in the Agreement.
- B. Use Form AIA G702 and Form AIA G703, edition stipulated in the Agreement.
- C. Electronic media printout including equivalent information will be considered in lieu of standard form specified; submit sample to Architect for approval.
- D. Forms filled out by hand will not be accepted.

- E. For each item, provide a column for listing each of the following:
1. Item Number.
  2. Description of work.
  3. Scheduled Values.
  4. Previous Applications.
  5. Work in Place and Stored Materials under this Application.
  6. Authorized Change Orders.
  7. Total Completed and Stored to Date of Application.
  8. Percentage of Completion.
  9. Balance to Finish.
  10. Retainage.
- F. Execute certification by signature of authorized officer.
- G. Use data from approved Schedule of Values. Provide dollar value in each column for each line item for portion of work performed and for stored products.
- H. List each authorized Change Order as a separate line item, listing Change Order number and dollar amount as for an original item of work.
- I. Submit one electronic and three hard-copies of each Application for Payment.
- J. Include the following with the application:
1. Transmittal letter as specified for submittals in Section 01 30 00.
  2. Construction progress schedule, revised and current as specified in Section 01 30 00.
  3. Current construction photographs specified in Section 01 30 00.
  4. Partial release of liens from major subcontractors and vendors.
  5. Project record documents as specified in Section 01 78 00, for review by Owner which will be returned to the Contractor.
  6. Affidavits attesting to off-site stored products.
- K. When Architect requires substantiating information, submit data justifying dollar amounts in question. Provide one copy of data with cover letter for each copy of submittal. Show application number and date, and line item by number and description.

## **1.5 MODIFICATION PROCEDURES**

- A. Submit name of the individual authorized to receive change documents and who will be responsible for informing others in Contractor's employ or subcontractors of changes to Contract Documents.
- B. For minor changes not involving an adjustment to the Contract Sum or Contract Time, Architect will issue instructions directly to Contractor.

- C. For other required changes, Architect will issue a document signed by Owner instructing Contractor to proceed with the change, for subsequent inclusion in a Change Order.
  - 1. The document will describe the required changes and will designate method of determining any change in Contract Sum or Contract Time.
  - 2. Promptly execute the change.
- D. For changes for which advance pricing is desired, Architect will issue a document that includes a detailed description of a proposed change with supplementary or revised drawings and specifications, a change in Contract Time for executing the change with a stipulation of any overtime work required and the period of time during which the requested price will be considered valid. Contractor shall prepare and submit a fixed price quotation within 10 days.
- E. Contractor may propose a change by submitting a request for change to Architect, describing the proposed change and its full effect on the work, with a statement describing the reason for the change, and the effect on the Contract Sum and Contract Time with full documentation and a statement describing the effect on Work by separate or other contractors. Document any requested substitutions in accordance with Section 01 60 00.
- F. Computation of Change in Contract Amount: As specified in the Agreement and Conditions of the Contract.
  - 1. For change requested by Architect for work falling under a fixed price contract, the amount will be based on Contractor's price quotation.
  - 2. For change requested by Contractor, the amount will be based on the Contractor's request for a Change Order as approved by Architect.
  - 3. For pre-determined unit prices and quantities, the amount will be based on the fixed unit prices.
  - 4. For change ordered by Architect without a quotation from Contractor, the amount will be determined by Architect based on the Contractor's substantiation of costs as specified for Time and Material work.
- G. Substantiation of Costs: Provide full information required for evaluation.
  - 1. On request, provide the following data:
    - a. Quantities of products, labor, and equipment.
    - b. Taxes, insurance, and bonds.
    - c. Overhead and profit.
    - d. Justification for any change in Contract Time.
    - e. Credit for deletions from Contract, similarly documented.
  - 2. Support each claim for additional costs with additional information:
    - a. Origin and date of claim.
    - b. Dates and times work was performed, and by whom.
    - c. Time records and wage rates paid.
    - d. Invoices and receipts for products, equipment, and subcontracts, similarly documented.
  - 3. For Time and Material work, submit itemized account and supporting data after completion of change, within time limits indicated in the Conditions of the Contract.

- H. Execution of Change Orders: Architect will issue Change Orders for signatures of parties as provided in the Conditions of the Contract.
- I. After execution of Change Order, promptly revise Schedule of Values and Application for Payment forms to record each authorized Change Order as a separate line item and adjust the Contract Sum.
- J. Promptly revise progress schedules to reflect any change in Contract Time, revise sub-schedules to adjust times for other items of work affected by the change, and resubmit.
- K. Promptly enter changes in Project Record Documents.

**1.6 APPLICATION FOR FINAL PAYMENT**

- A. Prepare Application for Final Payment as specified for progress payments, identifying total adjusted Contract Sum, previous payments, and sum remaining due.
- B. Application for Final Payment will not be considered until the following have been accomplished:
  - 1. All closeout procedures specified in Sections 01 77 00, 01 77 10, 01 77 22, 01 78 39, 01 88 13.

**PART 2 PRODUCTS - NOT USED**

**PART 3 EXECUTION - NOT USED**

**END OF SECTION 01 20 00**

SECTION 01 21 00

ALLOWANCES

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Administrative and procedural requirements governing allowances.
  - 1. Certain materials and equipment are specified in the contract documents by allowances. Allowances have been established in lieu of additional requirements and to defer selection of actual materials and equipment to a later date when additional information is available for evaluation. If necessary, additional requirements will be issued by change order.
- B. Related Requirements:
  - 1. General Conditions of the Contract for Construction.
  - 2. Individual Specifications Sections Listed Under Schedule of Allowances: Specification of products and installation under allowances.

1.2 COSTS INCLUDED IN ALLOWANCES

- A. Cost of product to Contractor or subcontractor, less applicable trade discounts.
- B. Delivery to site.
- C. Applicable taxes.

1.3 CONTRACTOR COSTS INCLUDED IN CONTRACT SUM

- A. Products handling at site, including unloading, uncrating and storage.
- B. Protection of products from elements and from damage.
- C. Labor for installation and finishing.
- D. Other expenses required to complete installation.
- E. Contractor overhead and profit.

1.4 ADJUSTMENT OF COSTS

- A. Should the net cost be more or less than the specified amount of the allowance, the contract sum will be adjusted accordingly by change order.
- B. Submit any claims for anticipated additional costs at the site, or other expenses caused by the selection under the allowance, prior to execution of the work.
- C. Submit documentation for actual additional costs at the site, or other expenses caused by the selection under the allowance, prior to execution of the work.
- D. Failure to submit claims within the designated time will constitute a waiver of claims for additional costs.

1.5 ARCHITECT RESPONSIBILITIES

- A. Consult with Contractor in consideration of products, suppliers and installers.
- B. Select products, obtain Owner's written decision, and transmit full information to Contractor as follows
  - 1. Manufacturer, product, model or catalog number, accessories, attachments and finishes.
  - 2. Supplier and installer as applicable.
  - 3. Cost to Contractor, delivered to site (and installed, if so specified).

## 1.6 CONTRACTOR RESPONSIBILITIES

- A. At the earliest practical date after award of the contract, advise Architect of the date when final selection and purchase of each product or system described by an allowance must be completed to avoid delaying the work.
- B. Assist Architect in determining suppliers; and installers; obtain proposals when requested.
- C. Make recommendations for Architect consideration.
- D. Promptly notify Architect of any reasonable objections against supplier or installer.
- E. On notification of selection execute purchase agreement with designated supplier and installer.
- F. Arrange for and process shop drawings, product data and samples.
- G. Arrange for delivery. Promptly inspect products upon delivery for completeness, damage and defects. Submit claims for transportation damage.
- H. Install, adjust and finish products.
- I. Provide warranties for products and installation.

## 1.7 CORRELATION WITH CONTRACTOR SUBMITTALS

- A. Schedule shop drawings, product data, samples and delivery dates, in progress schedule for products selected under allowances.

PART 2 - PRODUCTS – Not used.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Examine products covered by an allowance promptly on delivery for damage or defects. Return damaged or defective products to manufacturer for replacement.

### 3.2 PREPARATION

- A. Coordinate allowance work with related work to ensure proper integration and interface.

### 3.3 SCHEDULE OF ALLOWANCES

Allowance No. 1: Allow the lump sum of \$20,000 Owner's Contingency for the changes requested by the Owner.

END OF SECTION



## **SECTION 01 25 00**

### **SUBSTITUTION PROCEDURES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for substitutions.

##### **1.3 DEFINITIONS**

- A. Substitutions: Changes in products, materials, equipment, and methods of construction from those required by the Contract Documents and proposed by Contractor.
  - 1. Substitutions for Cause: Changes proposed by Contractor that are required due to changed Project conditions, such as unavailability of product, regulatory changes, or unavailability of required warranty terms.
  - 2. Substitutions for Convenience: Changes proposed by Contractor or Owner that are not required in order to meet other Project requirements but may offer advantage to Contractor or Owner.
- B. Products: Items purchased for incorporation in the Work, regardless if specifically purchased for the project or taken from the Contractor's previously purchased stock. The term product is inclusive for "material, equipment, assembly, system" and other terms of similar intent.

##### **1.4 SUBMITTALS**

- A. Substitution Requests: Submit three copies of each request for consideration. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Substitution Request Form: Use facsimile of form provided in Project Manual.
  - 2. Documentation: Show compliance with requirements for substitutions and the following, as applicable:
    - a. Statement indicating why specified product or fabrication or installation cannot be provided, if applicable.
    - b. Coordination information, including a list of changes or revisions needed to other parts of the Work and to construction performed by Owner and separate contractors, which are necessary to accommodate proposed substitution.
    - c. Detailed comparison of significant qualities of proposed substitution with those of the Work specified. Include annotated copy of applicable Specification Section. Significant qualities may include attributes such as performance, weight, size, durability, visual effect, sustainable design characteristics, warranties, and specific features and requirements indicated. Indicate deviations, if any, from the Work specified.
    - d. Product Data, including drawings and descriptions of products and fabrication and installation procedures.
    - e. Samples, where applicable or requested.

- f. Certificates and qualification data, where applicable or requested.
  - g. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners.
  - h. Material test reports from a qualified testing agency indicating and interpreting test results for compliance with requirements indicated.
  - i. Research reports evidencing compliance with building code in effect for Project, from ICC-ES.
  - j. Detailed comparison of Contractor's construction schedule using proposed substitution with products specified for the Work, including effect on the overall Contract Time. If specified product or method of construction cannot be provided within the Contract Time, include letter from manufacturer, on manufacturer's letterhead, stating date of receipt of purchase order, lack of availability, or delays in delivery.
  - k. Cost information, including a proposal of change, if any, in the Contract Sum.
  - l. Contractor's certification that proposed substitution complies with requirements in the Contract Documents except as indicated in substitution request, is compatible with related materials, and is appropriate for applications indicated.
  - m. Contractor's waiver of rights to additional payment or time that may subsequently become necessary because of failure of proposed substitution to produce indicated results.
3. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within seven days of receipt of a request for substitution. Architect will notify Contractor of acceptance or rejection of proposed substitution within fifteen days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.
- a. Forms of Acceptance: Change Order, Construction Change Directive, or Architect's Supplemental Instructions for minor changes in the Work.
  - b. Use product specified if Architect does not issue a decision on use of a proposed substitution within time allocated.

## **1.5 QUALITY ASSURANCE**

- A. Compatibility of Substitutions: Investigate and document compatibility of proposed substitution with related products and materials. Engage a qualified testing agency to perform compatibility tests recommended by manufacturers.

## **1.6 PROCEDURES**

- A. Coordination: Revise or adjust affected Work as necessary to integrate Work of the approved substitutions.

## **PART 2 PRODUCTS**

### **2.1 SUBSTITUTIONS**

- A. Substitutions for Cause: Submit requests for substitution immediately on discovery of need for change, but not later than 30 days prior to time required for preparation and review of related submittals.
  - 1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
    - a. Requested substitution is consistent with the Contract Documents and will produce indicated results.

## **SUBSTITUTION PROCEDURES**

- b. Substitution request is fully documented and properly submitted.
  - c. Requested substitution will not adversely affect Contractor's construction schedule.
  - d. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - e. Requested substitution is compatible with other portions of the Work.
  - f. Requested substitution has been coordinated with other portions of the Work.
  - g. Requested substitution provides specified warranty.
  - h. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.
- B. Substitutions for Convenience: Architect will consider requests for substitution if received prior to the Award of the Contract. Requests received after that time may be considered or rejected at discretion of Architect.
1. Conditions: Architect will consider Contractor's request for substitution when the following conditions are satisfied. If the following conditions are not satisfied, Architect will return requests without action, except to record noncompliance with these requirements:
- a. Requested substitution offers Owner a substantial advantage in cost, time, energy conservation, or other considerations, after deducting additional responsibilities Owner must assume. Owner's additional responsibilities may include compensation to Architect for redesign and evaluation services, increased cost of other construction by Owner, and similar considerations.
  - b. Requested substitution does not require extensive revisions to the Contract Documents.
  - c. Requested substitution is consistent with the Contract Documents and will produce indicated results.
  - d. Substitution request is fully documented and properly submitted.
  - e. Requested substitution will not adversely affect Contractor's construction schedule.
  - f. Requested substitution has received necessary approvals of authorities having jurisdiction.
  - g. Requested substitution is compatible with other portions of the Work.
  - h. Requested substitution has been coordinated with other portions of the Work.
  - i. Requested substitution provides specified warranty.
  - j. If requested substitution involves more than one contractor, requested substitution has been coordinated with other portions of the Work, is uniform and consistent, is compatible with other products, and is acceptable to all contractors involved.

### **PART 3 EXECUTION**

#### **3.1 NOT USED**

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**SECTION 01 33 00**

**SUBMITTAL PROCEDURES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Requirements for the submittal schedule and administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

**1.3 DEFINITIONS**

- A. Submittals: Written and graphic information and physical samples that require Architect's responsive action or are for information and do not require the architect's action.
- B. File Transfer Protocol (FTP): Communications protocol that enables transfer of files to and from another computer over a network and that serves as the basis for standard Internet protocols. An FTP site is a portion of a network located outside of network firewalls within which internal and external users are able to access files.
- C. Portable Document Format (PDF): An open standard file format used for representing documents in a device independent and display resolution independent fixed layout document format.

**1.4 SUBMITTALS**

- A. Submittal Schedule: Submit a schedule of submittals, arranged in chronological order by dates required by construction schedule. Include time required for review, ordering, manufacturing, fabrication, and delivery when establishing dates. Include additional time required for making corrections or revisions to submittals noted by Architect and additional time for handling and reviewing submittals required by those corrections.
  - 1. Coordinate submittal schedule with list of subcontracts, the schedule of values, and Contractor's construction schedule.
  - 2. Initial Submittal: Submit concurrently with construction schedule. Include submittals required during the first 60 days of construction. List those submittals required to maintain orderly progress of the Work and those required early because of long lead time for manufacture or fabrication.
  - 3. Final Submittal: Submit concurrently with the first complete submittal of Contractor's construction schedule. Submit revised submittal schedule to reflect changes in current status and timing for submittals.

**1.5 SUBMITTAL ADMINISTRATIVE REQUIREMENTS**

- A. Architect's Digital Data Files: Electronic digital data files of the Contract Drawings will be provided by Architect for Contractor's use in preparing submittals.
  - 1. Upon request, Architect will furnish Contractor one set of digital data drawing files of the Contract Drawings for use in preparing Shop Drawings and Project record drawings.
    - a. Architect makes no representations as to the accuracy or completeness of digital data drawing files as they relate to the Contract Drawings.
    - b. Digital Drawing Software Program: The Contract Drawings are available in Revit.

- c. Contractor shall execute a data licensing agreement in the form of AIA Document C106, Digital Data Licensing Agreement.
  - d. The following digital data files will be furnished for each appropriate discipline:
    - 1) Floor plans.
    - 2) Reflected ceiling plans.
- B. Coordination: Coordinate preparation and processing of submittals with performance of construction activities.
  - 1. Coordinate each submittal with fabrication, purchasing, testing, delivery, other submittals, and related activities that require sequential activity.
  - 2. Submit submittal items required for each Specification Section concurrently unless partial submittals for portions of the Work are indicated on approved submittal schedule.
  - 3. Submit action submittals and informational submittals required by the same Specification Section as separate packages under separate transmittals.
  - 4. Coordinate transmittal of different types of submittals for related parts of the Work so processing will not be delayed because of need to review submittals concurrently for coordination.
    - a. Architect reserves the right to withhold action on a submittal requiring coordination with other submittals until related submittals are received.
- C. Processing Time: Allow time for submittal review, including time for resubmittals. Time for review shall commence on Architect's receipt of submittal. No extension of the Contract Time will be authorized because of failure to transmit submittals enough in advance of the Work to permit processing, including resubmittals.
  - 1. Initial Review: Allow 15 days for initial review of each submittal. Allow additional time if coordination with subsequent submittals is required. Architect will advise Contractor when a submittal being processed must be delayed for coordination.
  - 2. Intermediate Review: If intermediate submittal is necessary, process in same manner as initial submittal.
  - 3. Resubmittal Review: Allow 15 days for review of each resubmittal.
  - 4. Sequential Review: Where sequential review of submittals by Architect's consultants, Owner, or other parties is indicated, allow 21 days for initial review of each submittal.
  - 5. Concurrent Consultant Review: Where the Contract Documents indicate that submittals may be transmitted simultaneously to Architect and to Architect's consultants, allow 15 days for review of each submittal. Submittal will be returned to Architect before being returned to Contractor.
- D. Electronic Submittals: Identify and incorporate information in each electronic submittal file:
  - 1. Assemble complete submittal package into a single indexed file incorporating submittal requirements of a single Specification Section and transmittal form with links enabling navigation to each item.
  - 2. Maximum allowable file size is 10MB except for shop drawing submittals. All submittals that are not shop drawings will be rejected if file size is larger than 10MB.
  - 3. Name file with submittal number or other unique identifier, including revision identifier.
    - a. File name shall use project identifier and Specification Section number followed by a decimal point and then a sequential number (e.g., LNHS-061000.01). Resubmittals shall include an alphabetic suffix after another decimal point (e.g., LNHS-061000.01.A).

- b. Provide means for insertion to permanently record Contractor's review and approval markings and action taken by Architect.
  - c. Transmittal Form for Electronic Submittals: Use software generated form from electronic project management software acceptable to Owner, containing the following information:
    - 1) Project name.
    - 2) Date.
    - 3) Name and address of Architect.
    - 4) Name of Construction Manager.
    - 5) Name of Contractor.
    - 6) Name of firm or entity that prepared submittal.
    - 7) Names of subcontractor, manufacturer, and supplier.
    - 8) Category and type of submittal.
    - 9) Submittal purpose and description.
    - 10) Specification Section number and title.
    - 11) Specification paragraph number or drawing designation and generic name for each of multiple items.
    - 12) Drawing number and detail references, as appropriate.
    - 13) Location(s) where product is to be installed, as appropriate.
    - 14) Related physical samples submitted directly.
    - 15) Indication of full or partial submittal.
    - 16) Transmittal number, numbered consecutively.
    - 17) Submittal and transmittal distribution record.
    - 18) Other necessary identification.
    - 19) Remarks.
  - d. Metadata: Include the following information as keywords in the electronic submittal file metadata:
    - 1) Project name.
    - 2) Number and title of appropriate Specification Section.
    - 3) Manufacturer name.
    - 4) Product name.
- E. Options: Identify options requiring selection by Architect.
- F. Deviations and Additional Information: On an attached separate sheet, prepared on Contractor's letterhead, record relevant information, requests for data, revisions other than those requested by Architect on previous submittals, and deviations from requirements in the Contract Documents, including minor variations and limitations. Include same identification information as related submittal.
- G. Resubmittals: Make resubmittals in same form and number of copies as initial submittal.
- 1. Note date and content of previous submittal.
  - 2. Note date and content of revision in label or title block and clearly indicate extent of revision.
  - 3. Resubmit submittals until they are marked with approval notation from Architect's action stamp.
- H. Distribution: Furnish copies of final submittals to manufacturers, subcontractors, suppliers, fabricators, installers, authorities having jurisdiction, and others as necessary for performance of construction activities. Show distribution on transmittal forms.

SUBMITTAL PROCEDURES

- I. Use for Construction: Retain complete copies of submittals on Project site. Use only final action submittals that are marked with approval notation from Architect's action stamp.

## **PART 2 PRODUCTS**

### **2.1 SUBMITTAL PROCEDURES**

- A. Submittal Procedure Requirements: Prepare and submit submittals required by individual Specification Sections. Types of submittals are indicated in individual Specification Sections.
  1. Submit electronic submittals via email and the Architect's project management program as PDF electronic files.
    - a. Architect will return annotated file. Annotate and retain one copy of file as an electronic Project record document file.
    - b. Certificates and Certifications Submittals: Provide statement that includes signature of entity responsible for preparing certification. Certificates and certifications shall be signed by an officer or other individual authorized to sign documents on behalf of that entity.
      - 1) Provide a digital signature with digital certificate on electronically submitted certificates and certifications where indicated.
      - 2) Provide a notarized statement on original paper copy certificates and certifications where indicated.
- B. Product Data: Collect information into a single submittal for each element of construction and type of product or equipment.
  1. If information must be specially prepared for submittal because standard published data are not suitable for use, submit as Shop Drawings, not as Product Data.
  2. Mark each copy of each submittal to show which products and options are applicable.
  3. Include the following information, as applicable:
    - a. Manufacturer's catalog cuts.
    - b. Manufacturer's product specifications.
    - c. Standard color charts.
    - d. Statement of compliance with specified referenced standards.
    - e. Testing by recognized testing agency.
    - f. Application of testing agency labels and seals.
    - g. Notation of coordination requirements.
    - h. Availability and delivery time information.
    - i. For equipment, include the following in addition to the above, as applicable:
      - 1) Wiring diagrams showing factory installed wiring.
      - 2) Printed performance curves.
      - 3) Operational range diagrams.
      - 4) Clearances required to other construction, if not indicated on accompanying Shop Drawings.



- j. Submit Product Data before or concurrent with Samples.
  - k. Submit Product Data in PDF electronic file.
- C. Shop Drawings: Prepare Project specific information, drawn accurately to scale. Do not base Shop Drawings on reproductions of the Contract Documents or standard printed data.
- 1. Preparation: Fully illustrate requirements in the Contract Documents. Include the following information, as applicable:
    - a. Identification of products.
    - b. Schedules.
    - c. Compliance with specified standards.
    - d. Notation of coordination requirements.
    - e. Notation of dimensions established by field measurement.
    - f. Relationship and attachment to adjoining construction clearly indicated.
    - g. Seal and signature of professional engineer if specified.
    - h. Sheet Size: Except for templates, patterns, and similar full size drawings, submit Shop Drawings on sheet size indicated in specification section.
    - i. Submit Shop Drawings in PDF electronic file.
    - j. BIM File Incorporation: Develop and incorporate Shop Drawing files into Building Information Model established for Project.
      - 1) Prepare Shop Drawings in same digital data software program, version, and operating system as the original Drawings.
- D. Samples: Submit Samples for review of kind, color, pattern, and texture for a check of characteristics with other elements and for a comparison of these characteristics between submittal and actual component as delivered and installed.
- 1. Transmit Samples that contain multiple, related components such as accessories together in one submittal package.
  - 2. Identification: Attach label on unexposed side of Samples that includes the following:
    - a. Generic description of Sample.
    - b. Product name and name of manufacturer.
    - c. Sample source.
    - d. Number and title of applicable Specification Section.
    - e. Specification paragraph number and generic name of each item.
    - f. For projects where electronic submittals are required, provide corresponding electronic submittal of Sample transmittal, digital image file illustrating Sample characteristics, and identification information for record.

- g. Disposition: Maintain sets of approved Samples at Project site, available for quality-control comparisons throughout the course of construction activity. Sample sets may be used to determine final acceptance of construction associated with each set.
  - 1) Samples that may be incorporated into the Work are indicated in individual Specification Sections. Such Samples must be in an undamaged condition at time of use.
  - 2) Samples not incorporated into the Work, or otherwise designated as Owner's property, are the property of Contractor.
- h. Samples: Submit full size units or Samples of size indicated, prepared from same material to be used for the Work, cured and finished in manner specified, and physically identical with material or product proposed for use, and that show full range of color and texture variations expected. Samples include, but are not limited to, the following: partial sections of manufactured or fabricated components; small cuts or containers of materials; complete units of repetitively used materials; swatches showing color, texture, and pattern; color range sets; and components used for independent testing and inspection.
  - 1) Number of Samples: Submit three sets of Samples. Architect will retain two Sample sets; remainder will be returned.
    - (a) Submit a single Sample where assembly details, workmanship, fabrication techniques, connections, operation, and other similar characteristics are to be demonstrated.
    - (b) If variation in color, pattern, texture, or other characteristic is inherent in material or product represented by a Sample, submit at least three sets of paired units that show approximate limits of variations.
- E. Product Schedule: As required in individual Specification Sections, prepare a written summary indicating types of products required for the Work and their intended location. Include the following information in tabular form:
  - 1. Type of product. Include unique identifier for each product indicated in the Contract Documents or assigned by Contractor if none is indicated.
  - 2. Manufacturer and product name, and model number if applicable.
  - 3. Number and name of room or space.
  - 4. Location within room or space.
  - 5. Submit product schedule in PDF electronic file.
- F. Test and Inspection Reports and Schedule of Tests and Inspections Submittals: Comply with requirements specified in Sections 01 45 00.
- G. Closeout Submittals required for Substantial Completion: Comply with requirements specified in Section 01 77 00.
- H. Maintenance Data: Comply with requirements specified in Section 01 78 23.
- I. Qualification Data: Prepare written information that demonstrates capabilities and experience of firm or person. Include lists of completed projects with project names and addresses, contact information of architects and owners, and other information specified.
- J. Welding Certificates: Prepare written certification that welding procedures and personnel comply with requirements in the Contract Documents. Submit record of Welding Procedure Specification and Procedure Qualification Record on AWS forms. Include names of firms and personnel certified.
- K. Installer Certificates: Submit written statements on manufacturer's letterhead certifying that Installer complies with requirements in the Contract Documents and, where required, is authorized by manufacturer for this specific Project.

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- L. Manufacturer Certificates: Submit written statements on manufacturer's letterhead certifying that manufacturer complies with requirements in the Contract Documents. Include evidence of manufacturing experience where required.
- M. Product Certificates: Submit written statements on manufacturer's letterhead certifying that product complies with requirements in the Contract Documents.
- N. Material Certificates: Submit written statements on manufacturer's letterhead certifying that material complies with requirements in the Contract Documents.
- O. Material Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting test results of material for compliance with requirements in the Contract Documents.
- P. Product Test Reports: Submit written reports indicating that current product produced by manufacturer complies with requirements in the Contract Documents. Base reports on evaluation of tests performed by manufacturer and witnessed by a qualified testing agency, or on comprehensive tests performed by a qualified testing agency.
- Q. Research Reports: Submit written evidence, from a model code organization acceptable to authorities having jurisdiction, that product complies with building code in effect for Project. Include the following information:
  - 1. Name of evaluation organization.
  - 2. Date of evaluation.
  - 3. Time period when report is in effect.
  - 4. Product and manufacturers' names.
  - 5. Description of product.
  - 6. Test procedures and results.
  - 7. Limitations of use.
- R. Preconstruction Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of tests performed before installation of product, for compliance with performance requirements in the Contract Documents.
- S. Compatibility Test Reports: Submit reports written by a qualified testing agency, on testing agency's standard form, indicating and interpreting results of compatibility tests performed before installation of product. Include written recommendations for primers and substrate preparation needed for adhesion.
- T. Field Test Reports: Submit written reports indicating and interpreting results of field tests performed either during installation of product or after product is installed in its final location, for compliance with requirements in the Contract Documents.
- U. Design Data: Prepare and submit written and graphic information, including, but not limited to, performance and design criteria, list of applicable codes and regulations, and calculations. Include list of assumptions and other performance and design criteria and a summary of loads. Include load diagrams if applicable. Provide name and version of software, if any, used for calculations. Include page numbers.

## **2.2 DELEGATED DESIGN SERVICES**

- A. Performance and Design Criteria: Where professional design services or certifications by a design professional are specifically required of Contractor by the Contract Documents, provide products and systems complying with specific performance and design criteria indicated.
  - 1. If criteria indicated are not sufficient to perform services or certification required, submit a written request for additional information to Architect.

## **SUBMITTAL PROCEDURES**

- B. Delegated Design Services Certification: In addition to Shop Drawings, Product Data, and required submittals, submit digitally signed PDF electronic file and three paper copies of certificate, signed and sealed by the responsible design professional, for each product and system specifically assigned to Contractor to be designed or certified by a design professional.
  - 1. Indicate that products and systems comply with performance and design criteria in the Contract Documents. Include list of codes, loads, and other factors used in performing these services.
- C. BIM File Incorporation: Incorporate delegated design drawing and data files into Building Information Model established for Project.
  - 1. Prepare delegated design drawings in the same digital data software program, version, and operating system as the original Drawings.

## 2.3 MSDS SHEETS

- A. The Texas Asbestos Health Protection Rules (Title 25. Health Services, Part I. Texas Department of Health Chapter 295 - Occupational Health, Subchapter C - Texas Asbestos Health Protection) were approved and became effective on October 20, 1992, and amended March 27, 2003. The Rules established the procedures and means to implement the provisions of Senate Bill 1341 and House Bill 79.
- B. Pursuant to the above referenced Rules, submit MSDS Sheets showing that materials used in the Project, contain 1.0 percent or less asbestos. This requirement pertains to every material in every Section of the Specifications, as applicable to the Project, whether written therein, or not. Submit MSDS Sheets for materials, including, but not limited to the following, as applicable to the Project.
  - 1. Surfacing Materials:
    - a. textured paint/coating;
    - b. spray applied insulation;
    - c. blown-in insulation
    - d. fire proofing insulation;
    - e. joint compound; and
    - f. spackling compounds
      - 1) Thermal System Insulation:
        - (a) taping compounds (thermal)
        - (b) HVAC duct insulation;
        - (c) boiler insulation;
        - (d) breaching insulation;
        - (e) pipe insulation; and
        - (f) thermal paper products
      - 2) Miscellaneous Material:
        - (a) cement wallboard/siding;
        - (b) asphalt/vinyl floor tile

- (c) vinyl sheet flooring/vinyl wall coverings;
- (d) floor backing;
- (e) construction mastic;
- (f) ceiling tiles/lay-in ceiling panels;
- (g) packing materials;
- (h) high temperature gaskets;
- (i) ductwork flexible fabric connections;
- (j) cooling towers;
- (k) heating and electrical ducts;
- (l) electrical panel partitions;
- (m) electrical cloth/electrical wiring insulation;
- (n) caulking/putties;
- (o) adhesives/mastics; and
- (p) wallboard

### **PART 3 EXECUTION**

#### **3.1 CONTRACTOR'S REVIEW**

- A. Action and Informational Submittals: Review each submittal and check for coordination with other Work of the Contract and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Architect.
- B. Approval Stamp: Stamp each submittal with a uniform, approval stamp. Include Project name and location, submittal number, Specification Section title and number, name of reviewer, date of Contractor's approval, and statement certifying that submittal has been reviewed, checked, and approved for compliance with the Contract Documents.

#### **3.2 ARCHITECT'S ACTION**

- A. Submittals: Architect will review each submittal, make marks to indicate corrections or revisions required, and return it. Architect will stamp each submittal with an action stamp and will mark stamp appropriately to indicate action.
- B. Partial submittals prepared for a portion of the Work will be reviewed when use of partial submittals has received prior approval from Architect.
- C. Incomplete submittals are not permitted, will be considered nonresponsive, and will be returned for resubmittal without review.
- D. Submittals not required by the Contract Documents will be returned by the Architect without action.

**END OF SECTION 01 33 00**

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## **SECTION 01 35 16**

### **ALTERATION PROJECT PROCEDURES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes: Special procedures for alteration Work.

##### **1.3 DEFINITIONS**

- A. Alteration Work: This term includes remodeling, renovation, repair, and maintenance work performed within existing spaces or on existing surfaces as part of the Project.
- B. Consolidate: To strengthen loose or deteriorated materials in place.
- C. Design Reference Sample: A sample that represents the Architect's prebid selection of Work to be matched; it may be existing Work or Work specially produced for the Project.
- D. Dismantle: To remove by disassembling or detaching an item from a surface, using gentle methods and equipment to prevent damage to the item and surfaces; disposing of items unless indicated to be salvaged or reinstalled.
- E. Match: To blend with adjacent construction and manifest no apparent difference in material type, species, cut, form, detail, color, grain, texture, or finish; as approved by Architect.
- F. Refinish: To remove existing finishes to base material and apply new finish to match original, or as otherwise indicated.
- G. Repair: To correct damage and defects, retaining existing materials, features, and finishes. This includes patching, piecing-in, splicing, consolidating, or otherwise reinforcing or upgrading materials.
- H. Replace: To remove, duplicate, and reinstall entire item with new material. The original item is the pattern for creating duplicates unless otherwise indicated.
- I. Replicate: To reproduce in exact detail, materials, and finish unless otherwise indicated.
- J. Reproduce: To fabricate a new item, accurate in detail to the original, and from either the same or a similar material as the original, unless otherwise indicated.
- K. Retain: To keep existing items that are not to be removed or dismantled.
- L. Strip: To remove existing finish down to base material unless otherwise indicated.

##### **1.4 COORDINATION**

- A. Alteration Work Subschedule: A construction schedule coordinating the sequencing and scheduling of alteration Work for entire Project, including each activity to be performed, and based on Contractor's Construction Schedule. Secure time commitments for performing critical construction activities from separate entities responsible for alteration Work.
  - 1. Schedule construction operations in sequence required to obtain best Work results.

2. Coordinate sequence of alteration Work activities to accommodate the following:
    - a. Owner's continuing occupancy of portions of existing building.
    - b. Owner's partial occupancy of completed Work.
    - c. Other known Work in progress.
    - d. Tests and inspections.
    - e. Commissioning.
  3. Detail sequence of alteration Work, with start and end dates.
  4. Utility Services: Indicate how long utility services will be interrupted. Coordinate shutoff, capping, and continuation of utility services.
  5. Use of elevator and stairs.
  6. Equipment Data: List gross loaded weight, axle-load distribution, and wheel base dimension data for mobile and heavy equipment proposed for use in existing structure. Do not use such equipment without certification from Contractor's professional engineer that the structure can support the imposed loadings without damage.
- B. Pedestrian and Vehicular Circulation: Coordinate alteration Work with circulation patterns within Project building(s) and site. Some Work is near circulation patterns. Circulation patterns cannot be closed off entirely and in places can be only temporarily redirected around small areas of Work. Access to restricted areas may not be obstructed. Plan and execute the Work accordingly.

#### **1.5 PROJECT MEETINGS FOR ALTERATION WORK**

- A. Preliminary Conference for Alteration Work: Before commencing alteration Work, conduct conference at site.
- B. Coordination Meetings: Conduct coordination meetings specifically for alteration Work at regular intervals. Coordination meetings are in addition to specific meetings held for other purposes, such as progress meetings and preinstallation conferences.
1. Review items of significance that affect progress of alteration Work.
    - a. Interface requirements of alteration work with other Project Work.
    - b. Status of submittals for alteration Work.
    - c. Access to alteration work locations.
    - d. Effectiveness of fire prevention plan.
    - e. Quality and work standards of alteration Work.
    - f. Change Orders for alteration Work.
  2. Reporting: Record meeting results and distribute copies to everyone in attendance and to others affected by decisions or actions resulting from each meeting.

#### **1.6 MATERIALS OWNERSHIP**

- A. Historic items, relics, and similar objects including, but not limited to, cornerstones and their contents, commemorative plaques and tablets, antiques, and other items of interest or value to Owner that may be



encountered or uncovered during the Work, regardless of whether they were previously documented, remain Owner's property.

1. Carefully dismantle and salvage each item or object in a manner to prevent damage and protect it from damage, then promptly deliver it to Owner where directed.
- B. Alteration Work Subschedule: Submit alteration Work subschedule within seven days of date established for commencement of alteration Work.
- C. Preconstruction Documentation: Show preexisting conditions of adjoining construction and site improvements that are to remain, including finish surfaces, that might be misconstrued as damage caused by Contractor's alteration Work operations.
- D. Alteration Work Program: Submit 30 days before Work begins.
- E. Fire Prevention Plan: Submit 30 days before Work begins.

## 1.7 QUALITY ASSURANCE

- A. Regulatory Requirements:
  1. Building Code: Comply with the IBC and the IEBC for alteration Work.
  2. Fire Prevention Plan: Prepare a written plan for preventing fires during the Work, including placement of fire extinguishers, fire blankets, rag buckets, and other fire control devices during each phase or process. Coordinate plan with Owner's fire protection equipment and requirements. Include fire watch personnel's training, duties, and authority to enforce fire safety.
  3. Safety and Health Standard: Comply with ANSI/ASSE A10.6.
  4. Title X Requirement: Each firm conducting activities that disturb painted surfaces shall be a Lead-Safe Certified Firm according to 40 CFR 745, Subpart E, and use only workers that are trained in lead safe Work practices.
  5. Accessibility Requirements: Comply with applicable requirements.
    - a. U.S. Architectural and Transportation Barriers Compliance Board Americans with Disabilities Act Accessibility Guidelines for Buildings and Facilities (ADAAG).
    - b. ICC/ANSI A117.1 Accessible and Useable Building and Facilities.
    - c. Texas Accessibility Standards (TAS).
- B. Specialist Qualifications: An experienced firm having minimum 10 years documented experience that is regularly engaged in specialty Work similar in nature, materials, design, and extent to alteration Work specified.
  1. Field Supervisor Qualifications: Full time supervisors experienced in specialty Work similar in nature, material, design, and extent to that indicated for this Project. Supervisors shall be on site when specialty Work begins and during its progress. Supervisors shall not be changed during Project except for causes beyond the control of the specialist firm.
    - a. Construct new mockups of required Work whenever a supervisor is replaced.
- C. Alteration Work Program: Prepare a written plan for alteration Work for whole Project, including each phase or process and protection of surrounding materials during operations. Show compliance with indicated methods and procedures specified in this and other Sections. Coordinate this whole Project alteration Work program with specific requirements of programs required in other alteration Work Sections.

1. Dust and Noise Control: Include locations of proposed temporary dust and noise control partitions and means of egress from occupied areas coordinated with continuing on site operations and other known Work in progress.
2. Debris Hauling: Include plans clearly marked to show debris hauling routes, turning radii, and locations and details of temporary protective barriers.

## **1.8 STORAGE AND HANDLING OF SALVAGED MATERIALS**

### **A. Salvaged Materials:**

1. Clean loose dirt and debris from salvaged items unless more extensive cleaning is indicated.
2. Pack or crate items after cleaning; cushion against damage during handling. Label contents of containers.
3. Store items in a secure area until delivery to Owner.
4. Transport items to Owner's storage area designated by Owner.
5. Protect items from damage during transport and storage.

### **B. Salvaged Materials for Reinstallation:**

1. Repair and clean items for reuse as indicated.
2. Pack or crate items after cleaning and repairing; cushion against damage during handling. Label contents of containers.
3. Protect items from damage during transport and storage.
4. Reinstall items in locations indicated. Comply with installation requirements for new materials and equipment unless otherwise indicated. Provide connections, supports, and miscellaneous materials to make items functional for use indicated.

### **C. Existing Materials to Remain: Protect construction indicated to remain against damage and soiling from construction Work. Where permitted by Architect, items may be dismantled and taken to a suitable, protected storage location during construction Work and reinstalled in their original locations after alteration and other construction work in the vicinity is complete.**

### **D. Storage: Catalog and store items within a weathertight enclosure where they are protected from moisture, weather, condensation, and freezing temperatures.**

1. Identify each item for reinstallation with a nonpermanent mark to document its original location. Indicate original locations on plans, elevations, sections, or photographs by annotating the identifying marks.
2. Secure stored materials to protect from theft.
3. Control humidity so that it does not exceed 85 percent. Maintain temperatures 5 degrees F (3 degrees C) or more above the dew point.

### **E. Storage Space:**

1. Owner will arrange for limited on site location(s) for free storage of salvaged material. Storage space includes security and climate control for stored material.

## **1.9 FIELD CONDITIONS**

- A. Survey of Existing Conditions: Record existing conditions that affect the Work by use of preconstruction photographs and/or preconstruction videos.
- B. Discrepancies: Notify Architect of discrepancies between existing conditions and Drawings before proceeding with removal and dismantling Work.
- C. Size Limitations in Existing Spaces: Materials, products, and equipment used for performing the work and for transporting debris, materials, and products shall be of sizes that clear surfaces within existing spaces, areas, rooms, and openings, including temporary protection, by 12 inches (300 mm) or more.

## **PART 2 PRODUCTS**

### **2.1 NOT USED.**

## **PART 3 EXECUTION**

### **3.1 PROTECTION**

- A. Protect persons, motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm resulting from alteration Work.
  - 1. Use proven protection methods, appropriate to each area and surface being protected.
  - 2. Provide temporary barricades, barriers, and directional signage to exclude the public from areas where alteration Work is being performed.
  - 3. Erect temporary barriers to form and maintain fire egress routes.
  - 4. Erect temporary protective covers over walkways and at points of pedestrian and vehicular entrance and exit that must remain in service during alteration Work.
  - 5. Contain dust and debris generated by alteration Work, and prevent it from reaching the public or adjacent surfaces.
  - 6. Provide shoring, bracing, and supports as necessary. Do not overload structural elements.
  - 7. Protect floors and other surfaces along hauling routes from damage, wear, and staining.
  - 8. Provide supplemental sound control treatment to isolate demolition Work from other areas of the building.
- B. Temporary Protection of Materials to Remain:
  - 1. Protect existing materials with temporary protections and construction. Do not remove existing materials unless otherwise indicated.
  - 2. Do not attach temporary protection to existing surfaces except as indicated as part of the alteration work program.
- C. Comply with each product manufacturer's written instructions for protections and precautions. Protect against adverse effects of products and procedures on people and adjacent materials, components, and vegetation.
- D. Utility and Communications Services:
  - 1. Notify Owner, Architect, authorities having jurisdiction, and entities owning or controlling wires, conduits, pipes, and other services affected by alteration Work before commencing operations.

2. Disconnect and cap pipes and services as required by authorities having jurisdiction, as required for alteration Work.
  3. Maintain existing services unless otherwise indicated; keep in service, and protect against damage during operations. Provide temporary services during interruptions to existing utilities.
- E. Existing Drains: Prior to the start of Work in an area, test drainage system to ensure that it is functioning properly. Notify Architect immediately of inadequate drainage or blockage. Do not begin Work in an area until the drainage system is functioning properly.
1. Prevent solids such as adhesive or mortar residue or other debris from entering the drainage system. Clean out drains and drain lines that become sluggish or blocked by sand or other materials resulting from alteration Work.
  2. Protect drains from pollutants. Block drains or filter out sediments, allowing only clean water to pass.
- F. Existing Roofing: Prior to the start of Work in an area, install roofing protection.

### **3.2 PROTECTION DURING APPLICATION OF CHEMICALS**

- A. Protect motor vehicles, surrounding surfaces of building, building site, plants, and surrounding buildings from harm or spillage resulting from applications of chemicals and adhesives.
- B. Cover adjacent surfaces with protective materials that are proven to resist chemicals selected for Project unless chemicals being used will not damage adjacent surfaces as indicated in alteration Work program. Use covering materials and masking agents that are waterproof and UV resistant and that will not stain or leave residue on surfaces to which they are applied. Apply protective materials according to manufacturer's written instructions. Do not apply liquid masking agents or adhesives to painted or porous surfaces. When no longer needed, promptly remove protective materials.
- C. Do not apply chemicals during winds of sufficient force to spread them to unprotected surfaces.
- D. Neutralize alkaline and acid wastes and legally dispose of off Owner's property.
- E. Collect and dispose of runoff from chemical operations by legal means and in a manner that prevents soil contamination, soil erosion, undermining of paving and foundations, damage to landscaping, or water penetration into building interior.

### **3.3 ALTERATION WORK**

- A. Have specialty Work performed only by qualified specialists.
- B. Ensure that Contractor supervisory personnel are present when Work begins and during its progress.
- C. Record existing Work before each procedure (preconstruction), and record progress during the Work. Use digital preconstruction documentation photographs or video recordings.
- D. Perform surveys of site as the Work progresses to detect hazards resulting from alterations.
- E. Notify Architect of visible changes in the integrity of material or components whether from environmental causes including biological attack, UV degradation, freezing, or thawing or from structural defects including cracks, movement, or distortion.
1. Do not proceed with the Work in question until directed by Architect.

**END OF SECTION 01 35 16**

**SECTION 01 40 00**

**QUALITY REQUIREMENTS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for quality assurance and quality control.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
  - 4. Specific test and inspection requirements are not specified in this Section.

**1.3 DEFINITIONS**

- A. Quality Assurance Services: Activities, actions, and procedures performed before and during execution of the Work to guard against defects and deficiencies and substantiate that proposed construction will comply with requirements.
- B. Quality Control Services: Tests, inspections, procedures, and related actions during and after execution of the Work to evaluate that actual products incorporated into the Work and completed construction comply with requirements. Services do not include contract enforcement activities performed by Architect.
- C. Mockups: Full size physical assemblies that are constructed on-site. Mockups are constructed to verify selections made under Sample submittals; to demonstrate aesthetic effects and, where indicated, qualities of materials and execution; to review coordination, testing, or operation; to show interface between dissimilar materials; and to demonstrate compliance with specified installation tolerances. Mockups are not Samples. Unless otherwise indicated, approved mockups establish the standard by which the Work will be judged.
  - 1. Laboratory Mockups: Full size physical assemblies constructed at testing facility to verify performance characteristics.
  - 2. Room Mockups: Mockups of typical interior spaces complete with wall, floor, and ceiling finishes, doors, windows, millwork, casework, specialties, furnishings and equipment, and lighting.
- D. Preconstruction Testing: Tests and inspections performed specifically for Project before products and materials are incorporated into the Work, to verify performance or compliance with specified criteria.
- E. Product Testing: Tests and inspections that are performed by an NRTL, an NVLAP, or a testing agency qualified to conduct product testing and acceptable to authorities having jurisdiction, to establish product performance and compliance with specified requirements.

- F. Source Quality Control Testing: Tests and inspections that are performed at the source, e.g., plant, mill, factory, or shop.
- G. Field Quality Control Testing: Tests and inspections performed on site for installation of the Work and for completed Work.
- H. Testing Agency: An entity engaged to perform specific tests, inspections, or both. Testing laboratory shall mean the same as testing agency.
- I. Installer/Applicator/Erector: Contractor or another entity engaged by Contractor as an employee, Subcontractor, or Sub-subcontractor, to perform particular construction operations, including installation, erection, application, and similar operations.
  - 1. Use of trade specific terminology in referring to a trade or entity does not require that certain construction activities be performed by accredited or unionized individuals, or that requirements specified apply exclusively to specific trade(s).
- J. Experienced: When used with an entity or individual, experienced means having successfully completed a minimum of five years documented experience with projects similar in nature, size, and extent; being familiar with special requirements indicated; and having complied with requirements of authorities having jurisdiction.

#### **1.4 CONFLICTING REQUIREMENTS**

- A. Referenced Standards: 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 conflicting requirements that are different, but apparently equal, to Architect 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 Architect for a decision before proceeding.

#### **1.5 SUBMITTALS**

- A. Shop Drawings: Submit plans, sections, and elevations, indicating materials and size of mockup construction.
  - 1. Indicate manufacturer and model number of individual components.
  - 2. Provide axonometric drawings for conditions difficult to illustrate in two dimensions.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  - 1. Specification Section number and title.
  - 2. Entity responsible for performing tests and inspections.
  - 3. Description of test and inspection.
  - 4. Identification of applicable standards.
  - 5. Identification of test and inspection methods.
  - 6. Number of tests and inspections required.
  - 7. Time schedule or time span for tests and inspections.

8. Requirements for obtaining samples.
9. Unique characteristics of each quality control service.

## **1.6 REPORTS AND DOCUMENTS**

- A. Test and Inspection Reports: Prepare and submit certified written reports specified. 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.
- B. Manufacturer's Technical Representative's Field Reports: Prepare written information documenting manufacturer's technical representative's tests and inspections specified in other Sections. Include the following:
  1. Name, address, and telephone number of technical representative making report.
  2. Statement on condition of substrates and their acceptability for installation of product.
  3. Statement that products at site comply with requirements.
  4. Summary of installation procedures being followed, whether they comply with requirements and, if not, what corrective action was taken.
  5. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  6. Statement whether conditions, products, and installation will affect warranty.
  7. Other required items indicated in individual Specification Sections.
- C. Factory Authorized Service Representative's Reports: Prepare written information documenting manufacturer's factory authorized service representative's tests and inspections specified in other Sections. Include the following:

1. Name, address, and telephone number of factory-authorized service representative making report.
  2. Statement that equipment complies with requirements.
  3. Results of operational and other tests and a statement of whether observed performance complies with requirements.
  4. Statement whether conditions, products, and installation will affect warranty.
  5. Other required items indicated in individual Specification Sections.
- D. 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.
- E. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

## 1.7 QUALITY ASSURANCE

- A. Qualifications establish the minimum qualification levels required; refer to individual Specification Sections for additional requirements.
- B. Manufacturer Qualifications: A firm experienced in manufacturing products or systems similar to those indicated and sufficient production capacity to produce required units.
- C. Fabricator Qualifications: A firm experienced in producing products similar to those indicated and with record of successful in service performance, as well as sufficient production capacity to produce required units.
- D. 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.
- E. Professional Engineer Qualifications: A professional engineer who is legally qualified to practice in the State of Texas, experienced in providing engineering services of the kind indicated. Engineering services are defined as those performed for installations of the system, assembly, or product that are similar in material, design, and extent to those indicated.
- F. Specialists: Certain Specification Sections 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. Requirements of authorities having jurisdiction supersede requirements for specialists.
- G. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
- H. Manufacturer's Technical Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to observe and inspect installation of manufacturer's products.
- I. Factory Authorized Service Representative Qualifications: An authorized representative of manufacturer who is trained and approved by manufacturer to inspect installation of manufacturer's products.



- J. Preconstruction Testing: Where testing agency is indicated to perform preconstruction testing for compliance with specified requirements for performance and test methods, comply with the following:
1. Contractor responsibilities include the following:
    - a. Provide test specimens representative of proposed products and construction.
    - b. Submit specimens with sufficient time for testing and analyzing results to prevent delaying the Work.
    - c. Provide sizes and configurations of test assemblies, mockups, and laboratory mockups to adequately demonstrate capability of products to comply with performance requirements.
    - d. Build site assembled test assemblies and mockups using installers who will perform same tasks for Project.
    - e. Build laboratory mockups at testing facility using personnel, products, and methods of construction indicated for the completed Work.
    - f. When testing is complete, remove test specimens, assemblies, mockups, and laboratory mockups; do not reuse products on Project.
  2. Testing Agency Responsibilities: Submit certified written report of each test, inspection, and similar quality assurance service to Architect, with copy to Contractor. Interpret tests and inspections and state in each report whether tested and inspected Work complies with or deviates from the Contract Documents.
- K. 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 Architect.
  2. Notify Architect a minimum of seven days in advance of dates and times when mockups will be constructed.
  3. Employ supervisory personnel who will oversee mockup construction. Employ workers that will be employed during the construction.
  4. Demonstrate the proposed range of aesthetic effects and workmanship.
  5. Obtain Architect's approval of mockups before starting Work, fabrication, or construction. Allow seven days for initial review and each re-review of each mockup.
  6. Maintain mockups during construction in an undisturbed condition as a standard for judging the completed Work.
  7. Demolish and remove mockups when directed unless otherwise indicated.
- L. Trade Preinstallation Conferences: Meeting minutes to be Contractor provided.

## **1.8 QUALITY CONTROL**

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

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, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
1. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
  2. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  3. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  4. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.
  5. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
  6. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
- C. Manufacturer's Field Services: Where indicated, engage a factory authorized service representative to inspect field assembled components and equipment installation, including service connections. Report results in writing as specified in Section 013300.
- D. Manufacturer's Technical Services: Where indicated, engage a manufacturer's technical representative to observe and inspect the Work. Manufacturer's technical representative's services include participation in preinstallation conferences, examination of substrates and conditions, verification of materials, observation of Installer activities, inspection of completed portions of the Work, and submittal of written reports.
- E. 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.
- F. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
1. Notify Architect 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. Do 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.

- G. Associated Services: Cooperate with agencies performing required tests, inspections, 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. Delivery of samples to testing agencies.
  6. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  7. Security and protection for samples and for testing and inspecting equipment at Project site.
- H. 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.
- I. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
1. Distribution: Distribute schedule to Owner, Architect, testing agencies, and each party involved in performance of portions of the Work where tests and inspections are required.

## **1.9 SPECIAL TESTS AND INSPECTIONS**

- A. Special Tests and Inspections: Owner will engage a qualified testing agency or special inspector to conduct special tests and inspections required by authorities having jurisdiction as the responsibility of Owner:
- B. Special Tests and Inspections: Conducted by a qualified testing agency or special inspector as required by authorities having jurisdiction, as indicated in individual Specification Sections.
1. Verifying that manufacturer maintains detailed fabrication and quality control procedures and reviews the completeness and adequacy of those procedures to perform the Work.
  2. Notifying Architect 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 Architect with copy to Contractor and to authorities having jurisdiction.
  4. Submitting a final report of special tests and inspections at Substantial Completion, which includes 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.

**PART 2 PRODUCTS**

**2.1 NOT USED**

**PART 3 EXECUTION**

**3.1 TEST AND INSPECTION LOG**

- A. Test and Inspection Log: 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 Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
- B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

**3.2 REPAIR AND PROTECTION**

- A. 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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 35 16 Alteration Project Procedures.
- 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 01 40 00**

**SECTION 01 45 00**

**TESTING AND INSPECTING SERVICES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Requirements and qualifications including but not limited to:
  - 1. Professional testing and laboratory services.
  - 2. Accessories necessary for the completion of testing and laboratory services.
- B. Testing and inspecting services are required to verify compliance with requirements specified or indicated. These services do not relieve Contractor of responsibility for compliance with the Contract Document requirements.
  - 1. Specific quality assurance and quality control requirements for individual construction activities are specified in the Sections that specify those activities. Requirements in those Sections may also cover production of standard products.
  - 2. Specified tests, inspections, and related actions do not limit Contractor's other quality assurance and quality control procedures that facilitate compliance with Contract Document requirements.
  - 3. Requirements for Contractor to provide quality assurance and quality control services required by Architect, Owner, or authorities having jurisdiction are not limited by provisions.
  - 4. Specific test and inspection requirements are not specified in this Section.
- C. A qualified independent testing laboratory selected and paid by Owner.
  - 1. The Owner will pay for the initial laboratory services of materials that comply with the requirements of the Contract Documents. The Contractor shall pay for testing and retesting of materials that do not comply with the requirements of the Contract Documents.
- D. Inspecting agency shall perform inspections and tests in accordance with the rules and regulations of the building code, local authorities, Specifications of ASTM, and the Contract Documents.
- E. Materials and workmanship found not in compliance with required standards or performance obligations shall be removed and replaced. Replacement and subsequent testing shall be at Contractor's expense.
- F. Where terms "Inspector" and "Laboratory" are used, it is meant and in reference to an officially designated and accredited inspector of the testing laboratory engaged by Owner.
- G. Laboratory inspections shall not relieve the Contractor or Fabricator of his responsibility to furnish materials and workmanship in accordance with the Contract Documents.
- H. Contractor or Fabricator shall cooperate with the testing laboratory in matters pertaining to the Work.
- I. Contractor to address deficiency and failed reports.

### 1.3 QUALITY ASSURANCE

- A. Testing Agency Qualifications: An NRTL, an NVLAP, or an independent agency with the experience and capability to conduct testing and inspecting indicated, documented according to ASTM E 329 and ASTM E534; and with additional qualifications specified in individual Sections; and, where required by authorities having jurisdiction, that is acceptable to authorities.
  - 1. NRTL: A nationally recognized testing laboratory according to 29 CFR 1910.7.
  - 2. NVLAP: A testing agency accredited according to NIST's National Voluntary Laboratory Accreditation Program.
  - 3. Testing agencies shall be insured against errors and omissions by a professional liability insurance policy having a minimum limit of liability of \$500,000.00.
- B. Inspection and testing services of the testing agency shall be under the direction of a Registered Engineer licensed in the State of Texas, charged with engineering managerial responsibility, and having a minimum of five (5) years engineering experience in inspection and testing of construction materials.
- C. Concrete Inspectors: Inspecting personnel monitoring concrete Work shall be ACI certified inspectors.
- D. Testing Equipment: Equipment shall be calibrated at intervals not exceeding 12 months by devices of accuracy traceable to the National Bureau of Standards.
- E. Referenced Standards: Latest adopted edition of standards referenced apply to the Work. In the event of conflict between the Contract Documents and referenced standards, the Contract Documents shall govern. In case of conflict between Contract Documents and the Building Code, the more stringent shall govern.

### 1.4 QUALITY CONTROL

- A. Owner Responsibilities: Where quality control services are indicated as Owner's responsibility, Owner will engage a qualified testing agency to perform the services.
  - 1. Owner 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.
  - 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, and the Contract Sum will be adjusted by Change Order.
- B. Contractor Responsibilities: Tests and inspections not explicitly assigned to Owner are Contractor's responsibility. Perform additional quality control activities required to verify that the Work complies with requirements, whether specified or not.
  - 1. Refer to the individual specification sections for specific requirements.
  - 2. Unless otherwise indicated, provide quality control services specified and those required by authorities having jurisdiction. Perform quality control services required of Contractor by authorities having jurisdiction, whether specified or not.
  - 3. Where services are indicated as Contractor's responsibility, engage a qualified testing agency to perform the quality control services. Contractor shall not employ same entity engaged by Owner, unless agreed to in writing by Owner.
  - 4. Notify testing agencies at least 24 hours in advance of time when Work that requires testing or inspecting will be performed.
  - 5. Where quality control services are indicated as Contractor's responsibility, submit a certified written report, in duplicate, of each quality control service.

6. Testing and inspecting requested by Contractor and not required by the Contract Documents are Contractor's responsibility.
7. Submit additional copies of each written report directly to authorities having jurisdiction, when they so direct.
8. Associated Responsibilities and Services: Cooperate with agencies performing required tests, inspections, 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:
  - a. Provide access to the Work.
  - b. Deliver of samples to testing laboratory, without cost to Owner, in adequate quantities of representative samples of materials that require testing and inspecting. Assist agency in obtaining samples.
  - c. Advise laboratory and Architect sufficiently in advance of construction operations to allow laboratory to complete required inspections or tests and to assign personnel for field inspection and testing as specified.
  - d. Provide facilities for storage and curing of concrete test samples on site for the first 24 hours and for subsequent field curing required by ASTM C31.
  - e. Incidental labor, facilities, and equipment necessary to assist laboratory personnel in obtaining and handling samples at the site.
  - f. Preliminary design mix proposed for use for material mixes that require control by testing agency.
  - g. Provide concrete mix designs in accordance with ACI 301 Section 3.9 made by an independent testing laboratory or qualified concrete supplier. Where mix designs by an independent testing laboratory are required, select and pay for laboratory.
  - h. Obtain required inspections or approvals of the building official. Inspection requests and notifications required by building code are responsibility of the Contractor.
  - i. Provide current welder certificates for each welder employed.
  - j. Provide fabrication and erection inspection and testing of welds in accordance with AWS D1.1, Chapter 6.
    - 1) Use prequalification of welding procedures in executing the Work.
  - k. Security and protection for samples and for testing and inspecting equipment at Project site.
9. Retesting/Reinspecting: Regardless of payment responsibility of the original tests or inspections, provide quality control services, including retesting and reinspecting, for construction that replaced Work failing to comply with the Contract Documents or Code requirements.
- C. Testing Agency Responsibilities: Cooperate with Architect and Contractor in performance of duties. Provide qualified personnel to perform required tests and inspections.
  1. Notify Architect 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. Do 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.
- D. Coordination: Coordinate sequence of activities to accommodate required quality assurance and quality 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.

#### **1.5 AUTHORITY AND DUTIES OF LABORATORY PERSONNEL**

- A. A representative of the testing laboratory, who has reviewed and is familiar with the project and specifications, shall participate in preconstruction conferences. The representative shall coordinate material testing and inspection requirements with the Contractor and its subcontractors consistent with the planned construction schedule. The laboratory representative shall attend conferences required or requested to address quality control issues.
- B. Laboratory personnel shall inspect and test materials, assemblies, specimens, and Work performed, including design mixes, methods and techniques and report the progress to the Architect.
- C. If material or Work fails to meet requirements of Contract Documents, laboratory inspector shall notify the Construction Manager, Architect, Engineers, supplier or subcontractor providing or preparing the materials or Work being tested of such failure.
- D. Laboratory personnel shall not perform the Work of the Contractor or act as foremen or superintendents. Work will be inspected as it progresses, but failure to detect defective Work or materials shall not prevent later rejection when a defect is discovered.
- E. Laboratory personnel are not authorized to revoke, alter, relax, enlarge, or release the requirements of the Contract Documents or approve or accept portions of Work, except where approval is specifically specified in the Specifications.
- F. Comply with building code requirements for Special Inspections.

#### **1.6 SUBMITTALS**

- A. Schedule of Tests and Inspections: Prepare a schedule of tests, inspections, and similar quality control services required by the Contract Documents. Coordinate and submit concurrently with Contractor's construction schedule. Update as the Work progresses.
- B. Schedule of Tests and Inspections: Prepare in tabular form and include the following:
  1. Specification Section number and title.
  2. Entity responsible for performing tests and inspections.
  3. Description of test and inspection.
  4. Identification of applicable standards.
  5. Identification of test and inspection methods.
  6. Number of tests and inspections required.



7. Time schedule or time span for tests and inspections.
  8. Requirements for obtaining samples.
  9. Unique characteristics of each quality control service.
- C. Test and Inspection Reports: Prepare and submit certified written reports specified. 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.
- D. Submit copies of reports of each inspection and test:
1. Owner, Program or Project Manager, Architect, and each Engineer or outside consultants regarding their particular phase of the project: One copy each.
  2. Construction Manager and Contractor: Two copies each.
- E. In addition to furnishing a written report, notify Construction Manager and Contractor verbally of uncorrected conditions or failures to comply with requirements of the Contract Documents, and immediately fax and email corresponding report to the Architect and Engineer.
- F. At completion of each trade or branch of Work requiring inspecting and testing, submit a final certificate attesting to satisfactory completion of Work and full compliance with requirements of Contract Documents.
- G. Submit copies of test results sealed by a Registered Engineer to municipal authorities having jurisdiction, as required.

## **1.7 TESTING LABORATORY GUIDELINES AND PROCEDURES**

- A. Technicians scheduled to perform specific testing services must be qualified to review and perform other services that overlap, i.e. earthwork, foundation inspections, rebar inspection, and concrete when scheduled concurrently at the site.

- B. Technician time for services performed will be reimbursed at a regular time rate. Compensation at the overtime rate will be considered for hours over eight hours spent at the site on a single day, field testing services performed on a Saturday or Sunday, and field services performed on a recognized holiday.
- C. There shall be a three hour minimum for each scheduled testing service. Vehicle charges will be included on a \$25.00 per trip basis.
- D. Cylinder pick up will be controlled by the technician performing test on a scheduled pick up day. If there are no testing services scheduled, the cylinder pick up fee is \$40.00 on week days and \$50.00 on weekends and holidays with no technician or vehicle charge.
- E. The Contractor shall bear the responsibility of scheduling the testing services. The Contractor and the testing laboratory shall assume full responsibility to coordinate the testing services. Cancellations or failed test shall be reimbursable to the Owner by the responsible party for the cancellations or failure of a test or service.

## **PART 2 PRODUCTS**

### **2.1 NOT USED.**

## **PART 3 EXECUTION**

### **3.1 TEST AND INSPECTION LOG**

- A. Test and Inspection Log: 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 Architect.
  - 4. Identification of testing agency or special inspector conducting test or inspection.
  - 5. Deficiency log.
- B. Maintain log at site. Post changes and revisions as they occur. Provide access to test and inspection log for Architect's reference during normal working hours.

### **3.2 TESTING AND INSPECTION SERVICES**

- A. Testing services shall include, but not be limited to those specified below or which are necessary or required during course of construction to ascertain specification compliance and which may be deemed necessary by Architect, Engineer, or Owner to ensure the quality of the Work.
- B. The Owner reserves the right to add to or delete any or all inspection and testing specified, excluding testing required by the applicable building codes.
- C. If conflicts arise between Drawings and Specifications, notify Architect immediately. The most stringent requirements shall dictate procedure.

### **3.3 INSPECTION OF PIPED SITE UTILITIES**

- A. Laboratory representative shall observe and report on the following:
  - 1. Proper alignment and grade of trenches.
  - 2. Pipe bedding and supports.

3. Pipe, joints, jointing material, and thrust blocks prior to installation of pipe.
4. Installation of pipe and joints.
5. Testing of piped utilities performed by Contractor.

#### **3.4 REPAIR AND PROTECTION**

- A. 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 or matching existing substrates and finishes. Restore patched areas and extend restoration into adjoining areas with durable seams that are as invisible as possible. Comply with the Contract Document requirements for cutting and patching in Section 01 35 16 Alteration Project Procedures.
- 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 01 45 00**

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**SECTION 01 50 00**

**TEMPORARY FACILITIES AND CONTROLS**

**PART 1 GENERAL**

**1.1 RELATED SECTIONS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Requirements for temporary utilities, support facilities, and security and protection facilities, including but not limited to:
  - 1. Water service and distribution.
  - 2. Sanitary facilities, including toilets, wash facilities, and drinking water facilities.
  - 3. Heating and cooling facilities.
  - 4. Ventilation.
  - 5. Electric power service.
  - 6. Lighting.
  - 7. Telephone service.
  - 8. Waste disposal facilities.
  - 9. Field office.
  - 10. Storage and fabrication sheds.
  - 11. Lifts and hoists.
  - 12. Construction aids and miscellaneous services and facilities.
  - 13. Environmental protection.
  - 14. Pest control.
  - 15. Enclosure fence.
  - 16. Security enclosure and lockup.
  - 17. Barricades, warning signs, and lights.
  - 18. Temporary partitions.
  - 19. Fire protection.
  - 20. Accessories necessary for a complete installation.

### 1.3 USE CHARGES

- A. Installation and removal of and use charges for temporary facilities shall be included in the Contract Sum unless otherwise indicated. Allow other entities to use temporary services and facilities without cost, including, but not limited to, Owner's construction forces, Architect, occupants of Project, testing agencies, and authorities having jurisdiction.
- B. Water and Sewer Service: Pay sewer service use charges for water used and sewer usage by all entities for construction operations.
- C. Electric Power Service: Pay electric power service use charges for electricity used by all entities for construction operations.

### 1.4 SUBMITTALS

- A. Site Plan: Show temporary facilities, utility hookups, staging areas, and parking areas for construction personnel.
- B. Moisture Protection Plan: Describe procedures and controls for protecting materials and construction from water absorption and damage.
  - 1. Describe delivery, handling, and storage provisions for materials subject to water absorption or water damage.
  - 2. Indicate procedures for discarding water damaged materials, protocols for mitigating water intrusion into completed Work, and replacing water damaged work.
  - 3. Indicate sequencing of Work that requires water, such as sprayed fire resistive materials, plastering, and tile grinding, and describe plans for dealing with water from these operations. Show procedures for verifying that wet construction has dried sufficiently to permit installation of finish materials.
- C. Dust and HVAC Control Plan: Submit coordination drawing and narrative that indicates the dust and HVAC control measures proposed for use, proposed locations, and proposed time frame for their operation. Identify further options if proposed measures are later determined to be inadequate. Include the following:
  - 1. HVAC system isolation schematic drawing.
  - 2. Location of proposed air-filtration system discharge.
  - 3. Waste handling procedures.
  - 4. Other dust control measures.

### 1.5 QUALITY ASSURANCE

- A. Regulatory Requirements:
  - 1. Accessible Temporary Egress: Comply with applicable provisions in the U.S. Architectural & Transportation Barriers Compliance Board ADA-ABA Accessibility Guidelines (ADAAG), ICC/ANSI A117.1, and Texas Accessibility Standards (TAS) 2012.
- B. Electric Service: Comply with NECA, NEMA, and UL standards and regulations for temporary electric service. Install service to comply with NFPA 70.
- C. Tests and Inspections: Arrange for authorities having jurisdiction to test and inspect each temporary utility before use. Obtain required certifications and permits.

## **1.6 PROJECT CONDITIONS**

- A. Temporary Use of Permanent Facilities: Engage Installer of each permanent service to assume responsibility for operation, maintenance, and protection of each permanent service during its use as a construction facility before Owner's acceptance, regardless of previously assigned responsibilities.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Provide new materials. Undamaged, previously used materials in serviceable condition may be used if approved by Architect. Provide materials suitable for use intended.
- B. Chain Link Fencing: Minimum 2 inch (50 mm), 0.148 inch (3.8 mm) thick, galvanized steel, chain link fabric fencing; minimum 6 feet (1.8 m) high with galvanized steel pipe posts; minimum 2-3/8 inch (60 mm) OD line posts and 2-7/8 inch (73 mm) OD corner and pull posts.
- C. Polyethylene Sheet: Reinforced, fire-resistive sheet, 10 mils (0.25 mm) minimum thickness, with flame spread rating of 15 or less per ASTM E 84.
- D. Dust Control Adhesive Surface Walk off Mats: Provide mats minimum 36 inches by 60 inches (914 mm by 1624 mm).
- E. Insulation: Unfaced mineral fiber blanket, manufactured from glass, slag wool, or rock wool; with maximum flame spread and smoke developed indexes of 25 and 50, respectively.
- F. Lumber and Plywood: Comply with requirements in Section 06 10 53.
- G. Gypsum Board: Minimum 1/2 inch (12.7 mm) thick by 48 inches (1219 mm) wide by maximum available lengths; Type X or Type C panels with tapered edges. Comply with Section 09 29 00.
- H. Paint: Comply with requirements in Section 09 90 00.
- I. Tarpaulins: Fire resistive labeled with flame-spread rating of 15 or less.
- J. Water: Potable.

### **2.2 TEMPORARY FACILITIES**

- A. Contractor's Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Provide elevated, stabilized concrete walkway from parking area to field offices.
- B. Architect's Field Offices: Prefabricated or mobile units with serviceable finishes, temperature controls, and foundations adequate for normal loading. Provide elevated, stabilized concrete walkway from parking area to field offices.
- C. Storage and Fabrication Sheds: Provide sheds sized, furnished, and equipped to accommodate materials and equipment for construction operations. Store combustible materials apart from building.

### **2.3 EQUIPMENT**

- A. Fire Extinguishers: Portable, UL rated; with class and extinguishing agent as required by locations and classes of fire exposures.
- B. Air Filtration Units: HEPA primary and secondary filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

- C. Drinking Water: Containerized, tap dispenser, bottled water drinking water units, including paper cup supply. Where power is accessible, provide electric water coolers to maintain dispensed water temperature at 45 degrees F to 55 degrees F (7.2 degrees C to 12.7 degrees C).
- D. Electrical Outlets: Properly configured, NEMA polarized outlets to prevent insertion of 110V to 120V plugs into higher voltage outlets; equipped with ground-fault circuit interrupters, reset button, and pilot light.
- E. Power Distribution System Circuits: Where permitted and overhead and exposed for surveillance, wiring circuits, not exceeding 125-V ac, 20-A rating, and lighting circuits may be nonmetallic sheathed cable.
- F. HVAC Equipment: Unless Owner authorizes use of permanent HVAC system, provide vented, self-contained, liquid propane gas or fuel oil heaters with individual space thermostatic control.
  - 1. Heating Units: Listed and labeled for type of fuel being consumed, by a qualified testing agency acceptable to authorities having jurisdiction, and marked for intended location and application.
  - 2. Permanent HVAC System: If Owner authorizes use of permanent HVAC system for temporary use during construction, provide filter with MERV of 8 at each return air grille in system and remove at end of construction. Clean HVAC system as required in Section 01 77 00 and install new filter with MERV 11 or greater.
- G. Air Filtration Units: Primary and secondary HEPA filter equipped portable units with four stage filtration. Provide single switch for emergency shutoff. Configure to run continuously.

## **PART 3 EXECUTION**

### **3.1 INSTALLATION**

- A. Locate facilities where they will serve project adequately and result in minimum interference with performance of the Work. Relocate and modify facilities as required by progress of the Work.
  - 1. Locate facilities to limit site disturbance as specified in Section 01 10 00.
- B. Provide each facility ready for use when needed to avoid delay. Do not remove until facilities are no longer needed or are replaced by authorized use of completed permanent facilities.

### **3.2 TEMPORARY UTILITY INSTALLATION**

- A. Install temporary service. Arrange with utility company, Owner, and existing users for time when service can be interrupted, if necessary, to make connections for temporary services.
- B. Sewers and Drainage: Provide temporary utilities to remove effluent lawfully.
  - 1. Connect temporary sewers to municipal system as directed by authorities having jurisdiction.
- C. Water Service: Install water service and distribution piping in sizes and pressures adequate for construction.
- D. Sanitary Facilities: Provide temporary toilets, wash facilities, and drinking water for use of construction personnel. Comply with requirements of authorities having jurisdiction for type, number, location, operation, and maintenance of fixtures and facilities.
  - 1. Disposable Supplies: Provide toilet tissue, paper towels, paper cups, and similar disposable materials for each facility. Maintain adequate supply. Provide covered waste containers for disposal of used material.
  - 2. Wash Facilities: Install wash facilities supplied with potable water at convenient locations for personnel who handle materials that require wash up. Dispose of drainage properly. Supply cleaning compounds appropriate for each type of material handled. Provide safety showers, eyewash fountains, and similar facilities for convenience, safety, and sanitation of personnel.



- E. Heating and Cooling: Provide temporary heating and cooling required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of low temperatures or high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed.
- F. Isolation of Work Areas in Occupied Facilities: Prevent dust, fumes, and odors from entering occupied areas.
  - 1. Prior to commencing Work, isolate the HVAC system in area where Work is to be performed according to coordination drawings.
    - a. Disconnect supply and return ductwork in Work area from HVAC systems servicing occupied areas.
    - b. Maintain negative air pressure within Work area using HEPA equipped air filtration units, starting with commencement of temporary partition construction, and continuing until removal of temporary partitions is complete.
  - 2. Maintain dust partitions during the Work. Use vacuum collection attachments on dust producing equipment. Isolate limited Work within occupied areas using portable dust containment devices.
  - 3. Perform daily construction cleanup and final cleanup using approved, HEPA filter equipped vacuum equipment.
- G. Ventilation and Humidity Control: Provide temporary ventilation required by construction activities for curing or drying of completed installations or for protecting installed construction from adverse effects of high humidity. Select equipment that will not have a harmful effect on completed installations or elements being installed. Coordinate ventilation requirements to produce ambient condition required and minimize energy consumption.
  - 1. Provide dehumidification systems when required to reduce substrate moisture levels to level required to allow installation or application of finishes.
- H. Electric Power Service: Provide electric power service and distribution system of sufficient size, capacity, and power characteristics required for construction operations. Install electric power service underground unless otherwise indicated.
  - 1. Electric Distribution: Provide receptacle outlets adequate for connection of power tools and equipment.
    - a. Provide waterproof connectors to connect separate lengths of electrical power cords if single lengths will not reach areas where construction activities are in progress. Do not exceed safe length voltage ratio.
    - b. Provide warning signs at power outlets other than 110 to 120 V.
    - c. Provide metal conduit, tubing, or metallic cable for wiring exposed to possible damage. Provide rigid steel conduits for wiring exposed on grades, floors, decks, or traffic areas.
    - d. Provide metal conduit enclosures or boxes for wiring devices.
    - e. Provide 4 gang outlets, spaced so 100 foot (30 m) extension cord can reach each area for power hand tools and task lighting. Provide a separate 125-V ac, 20-A circuit for each outlet.
- I. Lighting: Provide temporary lighting with local switching that provides adequate illumination for construction operations, observations, inspections, and traffic conditions.
  - 1. Install and operate temporary lighting that fulfills security and protection requirements without operating entire system.
  - 2. Install lighting for Project identification sign.

- J. Telephone Service: Provide temporary telephone service in common use facilities for use by construction personnel. Install one telephone line(s) for each field office.
1. Provide dedicated telephone line for each facsimile machine in each field office.
  2. At each telephone, post a list of important telephone numbers.
    - a. Police and fire departments.
    - b. Ambulance service.
    - c. Contractor's home office.
    - d. Contractor's emergency after-hours telephone number.
    - e. Architect's office.
    - f. Engineers' offices.
    - g. Owner's office.
    - h. Principal subcontractors' field and home offices.
  3. Provide superintendent with cellular telephone or portable two-way radio for use when away from field office.
- K. Electronic Communication Service: Provide a desktop computer and printer/scanner in the primary field office adequate for use by Architect and Owner to access Project electronic documents and maintain electronic communications.
1. Internet Service: Broadband modem, router and ISP, equipped with hardware firewall.
  2. Internet Security: Integrated software, providing software firewall, virus, spyware, phishing, and spam protection in a combined application.
  3. Backup: External hard drive, minimum 1 terabyte, with automated backup software providing daily backups.

### **3.3 SUPPORT FACILITIES INSTALLATION**

- A. Provide construction for temporary offices, shops, and sheds located within construction area or within 30 feet (9 m) of building lines that is noncombustible according to ASTM E 136. Comply with NFPA 241.
1. Maintain support facilities until Architect schedules Substantial Completion inspection. Remove before Substantial Completion. Personnel remaining after Substantial Completion will be permitted to use permanent facilities, under conditions acceptable to Owner.
- B. Temporary Use of Permanent Roads and Paved Areas: Locate temporary roads and paved areas in same location as permanent roads and paved areas. Construct and maintain temporary roads and paved areas adequate for construction operations. Extend temporary roads and paved areas, within construction limits indicated, as necessary for construction operations.
1. Recondition base after temporary use, including removing contaminated material, regrading, proofrolling, compacting, and testing.
  2. Delay installation of final course of permanent pavement until immediately before Substantial Completion.
- C. Traffic Controls: Comply with requirements of authorities having jurisdiction.

1. Protect existing site improvements to remain including curbs, pavement, and utilities.
2. Maintain access for fire-fighting equipment and access to fire hydrants.
- D. Parking: Provide temporary parking areas for construction personnel.
- E. Project Signs: Provide Project signs as indicated. Unauthorized signs are not permitted.
  1. Identification Signs: Provide Project identification signs as indicated on Drawings.
  2. Temporary Signs: Provide other signs as indicated and as required to inform public and individuals seeking entrance to Project.
    - a. Provide temporary, directional signs for construction personnel and visitors.
  3. Maintain and touchup signs so they are legible at all times.
- F. Waste Disposal Facilities: Provide waste collection containers in sizes adequate to handle waste from construction operations. Comply with requirements of authorities having jurisdiction.
- G. Lifts and Hoists: Provide facilities necessary for hoisting materials and personnel.
  1. Truck cranes and similar devices used for hoisting materials are considered "tools and equipment" and not temporary facilities.
- H. Temporary Elevator Use: Use of elevators is not permitted.
- I. Temporary Use of Permanent Stairs: Use of new stairs for construction traffic will be permitted, provided stairs are protected and finishes restored to new condition at time of Substantial Completion.

### **3.4 SECURITY AND PROTECTION FACILITIES INSTALLATION**

- A. Protection of Existing Facilities: Protect existing vegetation, equipment, structures, utilities, and other improvements at Project site and on adjacent properties, except those indicated to be removed or altered. Repair damage to existing facilities to the satisfaction of Owner and Architect.
- B. Environmental Protection: Provide protection, operate temporary facilities, and conduct construction as required to comply with environmental regulations and that minimize possible air, waterway, and subsoil contamination or pollution or other undesirable effects.
- C. Temporary Egress: Maintain temporary egress from existing occupied facilities as indicated and as required by authorities having jurisdiction.
- D. Temporary Partitions: Provide floor to ceiling dustproof partitions to limit dust and dirt migration and to separate occupied areas occupied from fumes and noise.
  1. Construct dustproof partitions with gypsum wallboard with joints taped on occupied side, and fire retardant treated plywood on construction operations side.
  2. Construct dustproof partitions with two layers of 6 mil (0.14 mm) polyethylene sheet on each side. Cover floor with two layers of 6 mil (0.14 mm) polyethylene sheet, extending sheets 18 inches (460 mm) up the sidewalls. Overlap and tape full length of joints. Cover floor with fire retardant treated plywood. Do not apply tape to finish floor surfaces.
    - a. Construct vestibule and airlock at each entrance through temporary partition with not less than 48 inches (1219 mm) between doors. Maintain water dampened foot mats in vestibule.

3. Where fire resistance rated temporary partitions are indicated or are required by authorities having jurisdiction, construct partitions according to the rated assemblies.
  4. Insulate partitions to control noise transmission to occupied areas.
  5. Seal joints and perimeter. Equip partitions with gasketed dustproof doors and security locks where openings are required.
  6. Protect air handling equipment.
  7. Provide walk off mats at each entrance through temporary partition.
- E. Temporary Fire Protection: Install and maintain temporary fire-protection facilities of types needed to protect against reasonably predictable and controllable fire losses. Comply with NFPA 241; manage fire-prevention program.
1. Prohibit smoking in construction areas.
  2. Supervise welding operations, combustion type temporary heating units, and similar sources of fire ignition according to requirements of authorities having jurisdiction.
  3. Develop and supervise an overall fire prevention and protection program for personnel at Project site. Review needs with local fire department and establish procedures to be followed. Instruct personnel in methods and procedures. Post warnings and information.
  4. Provide temporary standpipes and hoses for fire protection. Hang hoses with a warning sign stating that hoses are for fire protection purposes only and are not to be removed. Match hose size with outlet size and equip with suitable nozzles.

### **3.5 MOISTURE AND MOLD CONTROL**

- A. Contractor's Moisture Protection Plan: Avoid trapping water in finished Work. Document visible signs of mold that may appear during construction.
- B. Exposed Construction Phase: Before installation of weather barriers, when materials are subject to wetting and exposure and to airborne mold spores, protect as follows:
1. Protect porous materials from water damage.
  2. Protect stored and installed material from flowing or standing water.
  3. Keep porous and organic materials from coming into prolonged contact with concrete.
  4. Remove standing water from decks.
  5. Keep deck openings covered or dammed.
- C. Partially Enclosed Construction Phase: After installation of weather barriers but before full enclosure and conditioning of building, when installed materials are still subject to infiltration of moisture and ambient mold spores, protect as follows:
1. Do not load or install drywall or other porous materials or components, or items with high organic content, into partially enclosed building.
  2. Keep interior spaces reasonably clean and protected from water damage.
  3. Periodically collect and remove waste containing cellulose or other organic matter.

4. Discard or replace water-damaged material.
  5. Do not install material that is wet.
  6. Discard, replace, or clean stored or installed material that begins to grow mold.
  7. Perform Work in a sequence that allows any wet materials adequate time to dry before enclosing the material in drywall or other interior finishes.
- D. Controlled Condition Phase of Construction: After completing and sealing of the building enclosure but prior to the full operation of permanent HVAC systems, maintain as follows:
1. Control moisture and humidity inside building by maintaining effective dry-in conditions.
  2. Use permanent HVAC system to control humidity.
  3. Comply with manufacturer's written instructions for temperature, relative humidity, and exposure to water limits and moisture control.
    - a. Hygroscopic materials that may support mold growth, including wood and gypsum based products, which become wet during the course of construction and remain wet for 48 hours are considered defective and are to be removed and replaced.
    - b. Measure moisture content of materials that have been exposed to moisture during construction operations or after installation. Record readings beginning at time of exposure and continuing daily for 48 hours. Identify materials containing moisture levels higher than allowed. Report findings in writing to Architect.
    - c. Remove materials that cannot be completely restored to their manufactured moisture level within 48 hours.

### **3.6 OPERATION, TERMINATION, AND REMOVAL**

- A. Supervision: Enforce strict discipline in use of temporary facilities. To minimize waste and abuse, limit availability of temporary facilities to essential and intended uses.
- B. Maintenance: Maintain facilities in good operating condition until removal.
1. Maintain operation of temporary enclosures, heating, cooling, humidity control, ventilation, and similar facilities on a 24 hour basis where required to achieve indicated results and to avoid possibility of damage.
- C. Temporary Facility Changeover: Do not change over from using temporary security and protection facilities to permanent facilities until Substantial Completion unless otherwise required and approved by Owner and Architect.
- D. Termination and Removal: Remove each temporary facility when need for its service has ended, when it has been replaced by authorized use of a permanent facility, or no later than Substantial Completion. Complete or, if necessary, restore permanent construction that may have been delayed because of interference with temporary facility. Repair damaged Work, clean exposed surfaces, and replace construction that cannot be satisfactorily repaired.
1. Materials and facilities that constitute temporary facilities are property of Contractor. Owner reserves right to take possession of Project identification signs.
  2. Remove temporary roads and paved areas not intended for or acceptable for integration into permanent construction. Where area is intended for landscape development, remove soil and aggregate fill that do not comply with requirements for fill or subsoil. Remove materials contaminated with road oil, asphalt and other petrochemical compounds, and other substances that might impair growth of plant materials or

lawns. Repair or replace street paving, curbs, and sidewalks at temporary entrances, as required by authorities having jurisdiction.

3. At Substantial Completion, repair, renovate, and clean permanent facilities used during construction period. Comply with final cleaning requirements specified in Section 01 77 00."

**END OF SECTION 01 50 00**

**SECTION 01 60 00**

**PRODUCT REQUIREMENTS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for selection of products, including but not limited to:
  - 1. Product delivery, storage, and handling.
  - 2. Manufacturers' written warranties on products.
  - 3. Special warranties.
  - 4. Comparable products.

**1.3 DEFINITIONS**

- A. Products: Items obtained for incorporating into the Work, whether purchased for Project or taken from previously purchased stock. The term product includes the terms material, equipment, system, assembly, and terms of similar intent.
  - 1. Named Products: Items identified by manufacturer's product name, including make or model number or other designation shown or listed in manufacturer's published product literature current as of date of the Contract Documents.
  - 2. New Products: Items that have not previously been incorporated into another project or facility. Products salvaged or recycled from other projects are not considered new products.
  - 3. Comparable Product: Product that is demonstrated and approved through submittal process to have the indicated qualities related to type, function, dimension, in-service performance, physical properties, appearance, and other characteristics that equal or exceed those of specified product.
- B. Basis of Design Product Specification: A specification in which a specific manufacturer's product is named and accompanied by the words basis of design product, including make or model number or other designation, to establish the significant qualities related to type, function, dimension, in service performance, physical properties, appearance, and other characteristics for purposes of evaluating comparable products of additional manufacturers named in the specification.

**1.4 SUBMITTALS**

- A. Comparable Product Requests: Submit request for consideration of each comparable product. Identify product or fabrication or installation method to be replaced. Include Specification Section number and title and Drawing numbers and titles.
  - 1. Include data to indicate compliance with the specified requirements.
  - 2. Architect's Action: If necessary, Architect will request additional information or documentation for evaluation within one week of receipt of a comparable product request. Architect will notify Contractor of approval or rejection of proposed comparable product request within 15 days of receipt of request, or seven days of receipt of additional information or documentation, whichever is later.

- a. Form of Approval: As specified in Section 01 33 00.
  - b. Use product specified if Architect does not issue a decision on use of a comparable product request within time allocated.
- B. Basis of Design Product Specification Submittal: Comply with requirements in Section 01 33 00. Show compliance with requirements.

## **1.5 QUALITY ASSURANCE**

- A. Compatibility of Options: If Contractor is given option of selecting between two or more products for use on Project, select product compatible with products previously selected, even if previously selected products were also options.
- 1. Each contractor is responsible for providing products and construction methods compatible with products and construction methods of other contractors.
  - 2. If a dispute arises between contractors over concurrently selectable but incompatible products, Architect will determine which products shall be used.

## **1.6 PRODUCT DELIVERY, STORAGE, AND HANDLING**

- A. Deliver, store, and handle products using means and methods that will prevent damage, deterioration, and loss, including theft and vandalism. Comply with manufacturer's written instructions.
- B. Delivery and Handling:
- 1. Schedule delivery to minimize long term storage at site and to prevent overcrowding of construction spaces.
  - 2. Coordinate delivery with installation time to ensure minimum holding time for items that are flammable, hazardous, easily damaged, or sensitive to deterioration, theft, and other losses.
  - 3. Deliver products to Project site in an undamaged condition in manufacturer's original sealed container or other packaging system, complete with labels and instructions for handling, storing, unpacking, protecting, and installing.
  - 4. Inspect products on delivery to determine compliance with the Contract Documents and to determine that products are undamaged and properly protected.
- C. Storage:
- 1. Store products to allow for inspection and measurement of quantity or counting of units.
  - 2. Store materials in a manner that will not endanger Project structure.
  - 3. Store products that are subject to damage by the elements, under cover in a weathertight enclosure above ground, with ventilation adequate to prevent condensation.
  - 4. Protect foam plastic from exposure to sunlight, except to extent necessary for period of installation and concealment.
  - 5. Comply with product manufacturer's written instructions for temperature, humidity, ventilation, and weather-protection requirements for storage.
  - 6. Protect stored products from damage and liquids from freezing.



7. Provide a secure location and enclosure at site for storage of materials and equipment by Owner's construction forces. Coordinate location with Owner.

## **1.7 PRODUCT WARRANTIES**

- A. Warranties specified in other Sections shall be in addition to, and run concurrent with, other warranties required by the Contract Documents. Manufacturer's disclaimers and limitations on product warranties do not relieve Contractor of obligations under requirements of the Contract Documents.
  1. Manufacturer's Warranty: Written warranty furnished by individual manufacturer for a particular product and specifically endorsed by manufacturer to Owner.
  2. Warranty: Written warranty required by the Contract Documents to provide specific rights for Owner.
- B. Warranties: Prepare a written document that contains appropriate terms and identification, ready for execution.
  1. Specified Form: When specified forms are included with the Specifications, prepare a written document using indicated form properly executed.
  2. See other Sections for specific content requirements and particular requirements for submitting special warranties.
- C. Submittal Time: Comply with requirements in Section 01 77 00.

## **PART 2 PRODUCTS**

### **2.1 PRODUCT SELECTION PROCEDURES**

- A. Product Requirements: Provide products that comply with the Contract Documents, are undamaged and, unless otherwise indicated, are new at time of installation.
  1. Provide products complete with accessories, trim, finish, fasteners, and items needed for complete installation and indicated use and effect.
  2. Standard Products: If available, and unless custom products or nonstandard options are specified, provide standard products of types that have been produced and used successfully in similar situations on other projects.
  3. Owner reserves the right to limit selection to products with warranties not in conflict with requirements of the Contract Documents.
  4. Where products are accompanied by the term "as selected", Architect will make selection.
  5. Descriptive, performance, and reference standard requirements in the Specifications establish salient characteristics of products.
- B. Product Selection Procedures:
  1. Product: Where Specifications name a single manufacturer and product, provide the named product that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  2. Manufacturer/Source: Where Specifications name a single manufacturer or source, provide a product by the named manufacturer or source that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.

3. Products: Where Specifications include a list of names of both manufacturers and products, provide one of the products listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  4. Manufacturers: Where Specifications include a list of manufacturers' names, provide a product by one of the manufacturers listed that complies with requirements. Comparable products or substitutions for Contractor's convenience will not be considered.
  5. Basis of Design Product: Where Specifications name a product, or refer to a product indicated on Drawings, and include a list of manufacturers, provide the specified or indicated product or a comparable product by one of the other named manufacturers. Drawings and Specifications indicate sizes, profiles, dimensions, and characteristics based on the product named. Comply with requirements for consideration of an unnamed product by one of the named manufacturers.
- C. Visual Matching Specification: Where Specifications require "match Architect's sample", provide a product that complies with requirements and matches Architect's sample. Architect's decision will be final on whether a proposed product matches.
1. If no product available within specified category matches and complies with specified requirements, comply with requirements of Section 01 25 00 for proposal of product.
- D. Visual Selection Specification: Where Specifications include the phrase "selected by Architect" or similar phrase, select a product that complies with requirements. Architect will select color, gloss, pattern, density, or texture from manufacturer's product line that includes both standard and premium items.

## **2.2 COMPARABLE PRODUCTS**

- A. Conditions for Consideration: Architect will consider Contractor's request for comparable product when the following conditions are satisfied. If the following conditions are not satisfied, Architect may return requests without action, except to record noncompliance with these requirements:
1. Evidence that the proposed product does not require revisions to the Contract Documents, that it is consistent with the Contract Documents and will produce the indicated results, and that it is compatible with other portions of the Work.
  2. Detailed comparison of significant qualities of proposed product with those named in the Specifications. Significant qualities include attributes such as performance, weight, size, durability, visual effect, and specific features and requirements indicated.
  3. Evidence that proposed product provides specified warranty.
  4. List of similar installations for completed projects with project names and addresses and names and addresses of architects and owners, if requested.
  5. Samples, if requested.

## **PART 3 EXECUTION**

### **3.1 NOT USED**

**END OF SECTION 01 60 00**

**SECTION 01 77 00**

**CLOSEOUT PROCEDURES**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Final completion procedures.
  - 2. Warranties.
  - 3. Closeout documents
  - 4. Final cleaning.
  - 5. Repair of the Work.
- B. Failure to complete close-out requirements within 90 days after substantial completion may result in liquidated damages being assessed to the Contractor. Refer to Conditions of the Contract for additional requirements and liquidated damages.

**1.3 SUBMITTALS**

- A. Certified List of Incomplete Items (Punchlist): Final submittal at Final Completion.
- B. Certificates of Release: From authorities having jurisdiction.
- C. Certificate of Insurance: For continuing coverage.
- D. Field Report: For pest control inspection.
- E. Record Documents: Per requirements of Section 01 78 39.
- F. Warranties: Per requirements of paragraph 1.6.
- G. Closeout Documents: Per requirements of paragraph 1.7.
- H. List of Extra Materials: Per requirements of paragraph 1.7.

**1.4 FINAL COMPLETION PROCEDURES**

- A. Submittals Prior to Final Completion: Before requesting final inspection for determining final completion, complete the following:
  - 1. Close-out Documents: Provide bound closeout documents as described in paragraph 1.7. Refer to Document 00 73 00 - Supplementary Conditions to the General Conditions of the Contract for Construction, Paragraph 9.10 for additional information.
  - 2. Record Drawings: Provide record documents in accordance with 01 78 39.

3. Extra Stock: Transmit extra stock as required in accordance with Division 01 and individual specification sections.
  4. Submit a final Application for Payment in accordance with the Contract Documents.
  5. Certified List of Incomplete Items: Submit certified copy of Architect's Substantial 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.
  6. Certified List of deficiencies from the Commissioning Agent and Test, Adjust and Balance Consultants: Certified copy of the list shall state that each item has been completed or otherwise resolved for acceptance.
  7. Certificate of Insurance: Submit evidence of final, continuing insurance coverage complying with insurance requirements.
  8. 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.

#### **1.5 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.
  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 in a PDF electronic file. Architect will return annotated file.

#### **1.6 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 Substantial Completion is indicated, or when delay in submittal

of warranties might limit Owner's rights under warranty. All warranties submitted must comply with the construction documents and be issued in the Owner's Name.

- B. Partial Occupancy: Submit properly executed warranties within 15 days of completion of designated portions of the Work that are completed and occupied or used by Owner during construction period by separate agreement with Contractor.
- C. General Contractor's Warranty: Submit on company letterhead. This Warranty shall state all sections of Work performed by General Contractor's own forces, and warranty period for each section of Work.
- D. Subcontractors' Warranties: notarized, and submitted on attached Close-out Form "D". This Warranty shall state all sections of Work performed by the subcontractor and warranty period.
- E. Manufacturer and Supplier Warranties: Warranties should be issued in accordance with Contract requirements and in the Owner's name. All manufacturer warranties are effective as of the date of substantial completion, not at the date of start-up.
- F. Organize warranty documents into an orderly sequence based on the table of contents of Project Manual. Bind warranties and bonds in heavy duty, three ring, loose leaf binders, thickness necessary to accommodate contents, and sized to receive 8-1/2 inch by 11 inch (215 mm by 280 mm) paper.
- G. 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.
- H. Identify each binder on the front and spine with the typed or printed title "WARRANTIES," Project name, and name of Contractor.
- I. Warranty Electronic File: In addition to the Warranty Binder, 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.
- J. Provide additional copies of each warranty to include in operation and maintenance manuals.

## **1.7 CLOSEOUT DOCUMENTS**

- A. Coordinate the following items with the requirements of Document 00 73 CB - Supplementary Conditions to the General Conditions of the Contract for Construction.
- B. Prepare 3-ring D-slant binder cover and spine with printed title "CLOSEOUT DOCUMENTS", title of project, and subject matter of binder when multiple binders are required. Submit one (1) original and two (2) copies.
- C. Internally subdivide binder contents with permanent page dividers, logically organized as described below; with tab titling clearly printed under reinforced laminated plastic tabs.
- D. The close-out documents shall be neatly organized and easily useable as determined by the Architect and Owner. Separate Close-out Documents binders from Operations and Maintenance Manuals required under Section 01 77 22. Documents identified as "affidavit" shall be notarized.
- E. Contents: Prepare Table of Contents for each volume, with each item description identified, typed on white paper, in five (5) parts as follows:

Part 1: Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers. All General Contractor's vendors/suppliers and subcontractors that provided materials or performed any work related to this project must be listed on this form. Submit Final List of Subcontractors.

Part 2: Closeout Documents and Affidavits, include the following:

AIA G707 - Consent of Surety to Final Payment;

## **CLOSEOUT PROCEDURES**

AIA G706 - Contractor's Affidavit of Payment of Debts and Claims;

AIA G706A - Contractor's Affidavit of Release of Liens;

Subcontractor's Release of Lien: Include contractors', subcontractors' and direct material and equipment suppliers' separate final releases. Submit on attached Close-out Form "A" - Affidavit of Subcontractor's Release of Lien.

Part 3: Project documents and certificates, including the following:

Copy of Certificate of Substantial Completion (AIA G704);

Copy of All Permits;

Copy of Final Utility Bill or letter of transfer;

Copy of Certificate of Occupancy;

Certification of Project Compliance: Submit on attached Close-out Form "B". Owner and Architect will initiate form and forward to Contractor for signature once Substantial Completion is established;

Hazardous Material Certificate: Submit on attached Close-out Form "C". Affidavits from Contractor, Subcontractors and General Contractor's vendors or suppliers stating that no hazardous materials/products have been used or installed in this project.

Part 4: Receipts:

Extra Stock: Provide original receipts for delivery of "Extra Stock" items as described below, (if applicable). Receipts must be signed by an authorized Owner's representative;

In addition to the three (3) required close-out binders listed above, provide Architect with one (1) separate binder for their records containing the following:

Directory, listing names, addresses, and telephone numbers of Architect/Engineer, Contractor, Subcontractors, and major equipment suppliers;

All MSDS sheets for the project;

All warranties from Contractor, subcontractors, direct suppliers, and manufacturers.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Cleaning Agents: Use cleaning materials and agents recommended by manufacturer or fabricator of the surface to be cleaned. Do not use cleaning agents that are potentially hazardous to health or property or that might damage finished surfaces.

## **PART 3 EXECUTION**

### **3.1 FINAL CLEANING**

- A. 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 cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activities include but are not limited to:
  - a. Clean 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 foreign deposits.
  - c. Remove tools, construction equipment, machinery, and surplus material from Project site.
  - d. Remove snow and ice to provide safe access to building.
  - 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.
  - o. Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
  - p. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - q. Leave Project clean and ready for occupancy.

C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00.

### **3.2 REPAIR OF THE WORK**

- A. Complete repair and restoration operations before requesting inspection for determination of Substantial 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 01 77 00**



**SECTION 01 77 10**

**CLOSEOUT PROCEDURES FORM**

**CLOSE-OUT FORM "A"**

**SUBCONTRACTOR'S AFFIDAVIT OF RELEASE OF LIEN**

**STATE OF**

**COUNTY OF**

**KNOW ALL MEN BY THESE PRESENTS:**

**BEING FIRST DULY SWORN, DEPOSES AND SAYS:**

**THAT HE / SHE IS THE \_\_\_\_\_ OF \_\_\_\_\_,  
THE SUBCONTRACTOR WHO SUPPLIED, INSTALLED, AND /OR ERECTED THE WORK DESCRIBED BELOW,  
AND THAT, HE /SHE IS DULY AUTHORIZED TO MAKE THIS AFFIDAVIT AND SUBCONTRACTOR RELEASE:**

Project:

1. Owner: Galveston ISD
2. Architect: VLK Architects, Inc.
3. Work Performed: Central Middle School Renovation

**THAT ALL WORK REQUIRED UNDER THE SUBJECT SUBCONTRACTOR OF THE SUBJECT CONSTRUCTION PROJECT HAS BEEN PERFORMED IN ACCORDANCE WITH THE TERMS THEREOF, THAT ALL MATERIAL MEN, SUB-SUBCONTRACTORS, MECHANICS, AND LABORERS HAVE BEEN PAID AND SATISFIED IN FULL AND THAT THERE ARE NO OUTSTANDING CLAIMS OF ANY CHARACTER ARISING OUT OF THE PERFORMANCE OF SAID SUBCONTRACTOR WHICH HAVE NOT BEEN PAID AND SATISFIED IN FULL.**

**THAT TO THE BEST OF HIS / HER KNOWLEDGE AND BELIEF, THERE ARE NO UNSATISFIED CLAIMS FOR DAMAGES RESULTING FROM INJURY OR DEATH TO ANY EMPLOYEES, SUB-SUBCONTRACTORS, OR THE PUBLIC AT LARGE ARISING OUT OF THE PERFORMANCE OF SAID SUBCONTRACT, OR ANY SUITS OR CLAIMS FOR ANY OTHER DAMAGES OF ANY KIND, NATURE, OR DESCRIPTION WHICH MIGHT CONSTITUTE A LIEN UPON THE PROPERTY OF THE OWNER.**

**THAT HE / SHE HAS RECEIVED FULL PAYMENT OF ALL SUMS DUE HIM / HER FOR MATERIALS FURNISHED AND SERVICES RENDERED BY THE UNDERSIGNED IN CONNECTION WITH THE PERFORMANCE OF SAID SUBCONTRACT AND HAS AND DOES HEREBY RELEASE THE OWNER AND THE ARCHITECT AND HIS CONSULTANTS AND THE CONTRACTOR FROM ANY AND ALL CLAIMS OF ANY CHARACTER ARISING OUT OF OR IN ANY WAY CONNECTED WITH PERFORMANCE OF SAID SUBCONTRACT.**

Name of Subcontractor

1. (Title)



**1. BRIEF DESCRIPTION OF PROJECT:**

**2. CERTIFICATION OF DESIGN AND CONSTRUCTION**

THE INTENT OF THIS DOCUMENT IS TO ASSURE THAT THE SCHOOL DISTRICT HAS PROVIDED TO THE ARCHITECT/ENGINEER THE REQUIRED INFORMATION AND THE ARCHITECT/ENGINEER HAS REVIEWED THE SCHOOL FACILITIES STANDARDS AS REQUIRED BY THE STATE OF TEXAS, AND USED HIS/HER REASONABLE PROFESSIONAL JUDGMENT AND CARE IN THE ARCHITECTURAL/ENGINEERING DESIGN AND THAT THE CONTRACTOR HAS CONSTRUCTED THE PROJECT IN A QUALITY MANNER IN GENERAL CONFORMANCE WITH THE DESIGN REQUIREMENTS AND THAT THE SCHOOL DISTRICT CERTIFIES TO PROJECT COMPLETION.

3. THE DISTRICT CERTIFIES THAT THE EDUCATIONAL PROGRAM AND THE EDUCATIONAL SPECIFICATIONS OF THIS FACILITY ALONG WITH THE IDENTIFIED BUILDING CODE TO BE USED HAVE BEEN PROVIDED TO THE ARCHITECT/ENGINEER.

DISTRICT:  
DATE:

BY:

4. THE ARCHITECT/ENGINEER CERTIFIES THE ABOVE INFORMATION WAS RECEIVED FROM THE SCHOOL DISTRICT, AND THAT THE BUILDING(S) WERE DESIGNED IN ACCORDANCE WITH THE APPLICABLE BUILDING CODES. FURTHER, THE FACILITY HAS BEEN DESIGNED TO MEET OR EXCEED THE DESIGN CRITERIA RELATING TO SPACE (MINIMUM SQUARE FOOTAGE), EDUCATIONAL ADEQUACY, AND CONSTRUCTION QUALITY AS CONTAINED IN THE SCHOOL FACILITIES STANDARDS AS ADOPTED BY THE COMMISSIONER OF EDUCATION, JUNE 9, 2003, AND AS PROVIDED BY THE DISTRICT.

ARCHITECT/ENGINEER:  
DATE:

BY:

5. THE CONTRACTOR/CM CERTIFIES THAT THIS PROJECT HAS BEEN CONSTRUCTED IN GENERAL CONFORMANCE WITH THE CONSTRUCTION DOCUMENTS AS PREPARED BY THE ARCHITECT/ENGINEER LISTED ABOVE.

CONTRACTOR/CM:  
DATE:

BY:

6. THE DISTRICT CERTIFIES COMPLETION OF THE PROJECT (AS DEFINED BY THE ARCHITECT/ENGINEER AND CONTRACTOR).

DISTRICT:  
DATE:

BY:

**INSTRUCTIONS FOR COMPLETION OF "CERTIFICATION OF PROJECT COMPLIANCE" FORM**

**SECTION 1. IDENTIFY THE FOLLOWING:**

- A. – name and address of the school facility
- B. – name of the school district
- C. – the Architect/Engineer and Contractor
- D. – the date of execution of the construction contract
- E. – the date that the school district authorized the superintendent to hire an architect/engineer
- F. scope of the project.

**SECTION 2. THIS SECTION OUTLINES THE INTENT OF THE DOCUMENT. NO ACTION REQUIRED.**

**SECTION 3. THIS SECTION IS TO BE EXECUTED BY THE SCHOOL DISTRICT UPON TRANSMITTAL OF THE INFORMATION (AS LISTED) TO THE ARCHITECT/ENGINEER AND IS TO REMAIN IN THE CUSTODY OF THE SCHOOL DISTRICT THROUGHOUT THE ENTIRE PROJECT.**

**SECTION 4. THIS SECTION IS TO BE EXECUTED BY THE ARCHITECT/ENGINEER UPON COMPLETION OF THE PLANS AND SPECIFICATIONS AND IN CONJUNCTION WITH THE COMPLETION OF THE PLAN REVIEW FOR CODE COMPLIANCE (REF. 19 TAC §61.1033 OR §61.1036, SCHOOL FACILITIES STANDARDS) AND RETURNED TO THE SCHOOL DISTRICT'S FILES.**

**SECTION 5. THIS SECTION IS TO BE EXECUTED BY THE CONTRACTOR UPON SUBSTANTIAL COMPLETION OF THE PROJECT AND RETAINED IN THE SCHOOL DISTRICT'S FILES.**

**SECTION 6. THIS SECTION IS TO BE EXECUTED BY THE SCHOOL DISTRICT UPON ACCEPTANCE AND OCCUPANCY OF THE PROJECT.**

**NOTE: DO NOT SUBMIT THIS DOCUMENT TO THE TEXAS EDUCATION AGENCY. THE SCHOOL DISTRICT WILL RETAIN THIS DOCUMENT IN THEIR FILES INDEFINITELY UNTIL REVIEW AND/OR SUBMITTAL IS REQUIRED BY REPRESENTATIVES OF THE TEXAS EDUCATION AGENCY.**

**CLOSE-OUT FORM "C"**

**SUBCONTRACTOR HAZARDOUS MATERIAL CERTIFICATE**

**THE STATE OF \_\_\_\_\_ PROJECT: TECHNOLOGY WAREHOUSE**

**COUNTY OF \_\_\_\_\_ OWNER: CLEAR CREEK INDEPENDENT SCHOOL DISTRICT**

A. ARCHITECT: VLK Architects, Inc.

**KNOW ALL MEN BY THESE PRESENTS:**

**BEING FIRST DULY SWORN, DEPOSES AND SAYS THAT HE / SHE IS THE**

A. ,the subcontractor / supplier who constructed or provided the section(s) of work referenced above, and that he / she is duly authorized to certify to the best of his / her information, knowledge, and belief no asbestos, lead or PCB containing products have been incorporated into the project.

1. Name of Subcontractor / Supplier
2. (Title)





## **SECTION 01 77 22**

### **SUBSTANTIAL COMPLETION PROCEDURES**

#### **PART 1 GENERAL**

##### **1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

##### **1.2 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for contract closeout, including, but not limited to, the following:
  - 1. Substantial Completion procedures.

##### **1.3 SUBMITTALS**

- A. Contractor's List of Incomplete Items (Punchlist): Initial submittal at Substantial Completion.

##### **1.4 SUBSTANTIAL 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 Substantial Completion: Minimum of 10 days prior to requesting an inspection for determining date of Substantial Completion. List items that are incomplete at time of request.
  - 1. Certificates of Release: Obtain and submit releases from all (i.e. city, county, authorities) authorities having jurisdiction 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, 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. List of Extra Materials: 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 Architect's signature for receipt of submittals.
  - 5. Submit test/adjust/balance and commissioning records from Owner vendor.
  - 6. Submit changeover information related to Owner's occupancy, use, operation, and maintenance.
- C. Procedures Prior to Substantial Completion: A minimum of 10 days prior to requesting inspection for determining date of Substantial Completion, submit list items that are incomplete at time of request. Refer to Section 00 70 CB Supplementary Conditions to the Contract for Construction.
  - 1. All inspections by governmental authorities having jurisdiction over the project must have been finalized, any remedial work required by those authorities must have been completed, and Certificates of Occupancy

#### **SUBSTANTIAL COMPLETION PROCEDURES**

- and similar governmental approval forms must have been issued and copies delivered to the Owner and Architect.
2. All work, both interior and exterior, shall have been completed and cleaned except minor items which if completed after occupancy, will not, in the Owner's opinion, cause interference to the Owner's use of the building or any portion thereof. A significantly large number of items to be completed or corrected will preclude the Architect from issuing a Certificate of Substantial Completion. The Owner and Architect will be the sole judge of what constitutes a significantly large number of items.
  3. Local fire marshal approval certificate, or similar Certificate of Occupancy from the governing agency, must be delivered to the Owner.
  4. All final interior clean-up must be complete.
  5. Complete startup and testing of systems and equipment.
  6. All HVAC air and water balancing must be complete.
  7. All required commissioning must be complete.
  8. All Energy Management Systems must be complete and fully operational and demonstrated to the Owner.
  9. All communications equipment, telephone system, and P.A. systems must be complete and demonstrated to the Owner.
  10. All final lockset cores must be installed and all final Owner directed keying completed.
  11. All room plaques and exterior signage must be completed.
  12. All Owner demonstrations must be completed including kitchen equipment, HVAC equipment, plumbing equipment, and electrical equipment.
  13. A final certificate of occupancy must be signed by the Contractor and delivered to the Owner.
  14. Perform preventive maintenance on equipment used prior to Substantial Completion.
  15. Instruct Owner's personnel in operation, adjustment, and maintenance of products, equipment, and systems in accordance with Sections 01 78 23 and 01 79 00. Submit demonstration and training video recordings as required.
  16. Participate with Owner in conducting inspection and walkthrough with local emergency responders.
  17. Terminate and remove temporary facilities from site, including mockups, construction tools, and similar elements and restore or configure area to required or original condition.
  18. Complete final cleaning requirements, including touchup painting.
  19. Touch up and otherwise repair and restore marred exposed finishes to eliminate visual defects.
  20. Advise Owner of pending insurance changeover requirements.
  21. Comply with conditional lien regulations.
- D. Inspection: Submit written request for inspection to determine Substantial 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 Substantial 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.

## **PART 2 PRODUCTS**

### **2.1 NOT USED.**

## **PART 3 EXECUTION**

### **3.1 FINAL CLEANING**

- A. 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 cleaning operations before requesting inspection for certification of Substantial Completion for entire Project or for a designated portion of Project. Cleaning activities include but are not limited to:
    - a. Clean 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 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. Remove snow and ice to provide safe access to building.
    - f. 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.
    - g. Remove debris and surface dust from limited access spaces, including roofs, plenums, shafts, trenches, equipment vaults, manholes, attics, and similar spaces.
    - h. Sweep concrete floors broom clean in unoccupied spaces.
    - i. Vacuum carpet and similar soft surfaces, removing debris and excess nap; clean according to manufacturer's recommendations if visible soil or stains remain.
    - j. 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.
    - k. Remove labels that are not permanent.
    - l. Wipe surfaces of mechanical and electrical equipment, elevator equipment, and similar equipment. Remove excess lubrication, paint and mortar droppings, and other foreign substances.
    - m. Clean plumbing fixtures to a sanitary condition, free of stains, including stains resulting from water exposure.

- n. Replace disposable air filters and clean permanent air filters. Clean exposed surfaces of diffusers, registers, and grills.
  - o. Clean ducts, blowers, and coils if units were operated without filters during construction or that display contamination with particulate matter on inspection.
  - p. Clean HVAC system in compliance with NADCA Standard 1992-01. Provide written report on completion of cleaning.
  - q. Clean light fixtures, lamps, globes, and reflectors to function with full efficiency.
  - r. Leave Project clean and ready for occupancy.
- C. Construction Waste Disposal: Comply with waste disposal requirements in Section 01 50 00.

**END OF SECTION 01 77 22**

**SECTION 01 78 39**

**PROJECT RECORD DOCUMENTS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and other Division 01 Specification Sections, apply to this Section.

**1.2 SUMMARY**

- A. Section Includes: Administrative and procedural requirements for project record documents, including but not limited to:
  - 1. Record Drawings.
  - 2. Record Specifications.
  - 3. Record Product Data.
  - 4. Miscellaneous record submittals.

**1.3 CLOSEOUT SUBMITTALS**

- A. Record Drawings:
  - 1. Number of Copies: Submit one set of marked up record prints.
  - 2. Number of Copies: Submit copies of record Drawings:
    - a. Initial Submittal:
      - 1) Submit PDF electronic files of scanned record prints and one of file prints.
      - 2) Submit record digital data files and one sets of plots.
      - 3) Architect will indicate whether general scope of changes, additional information recorded, and quality of drafting are acceptable.
    - b. Final Submittal:
      - 1) Submit PDF electronic files of scanned record prints and three sets of prints.
      - 2) Submit record digital data files and three sets of record digital data file plots.
      - 3) Plot each drawing file, whether or not changes and additional information were recorded.
- B. Record Specifications: Submit one paper copy and one annotated PDF electronic file of the Project Specifications, including addenda and contract modifications.
- C. Record Product Data: Submit one paper copy and one annotated PDF electronic file and directory of each submittal.
  - 1. Where record Product Data are required as part of operation and maintenance manuals, submit duplicate marked up Product Data as a component of manual.
- D. Miscellaneous Record Submittals: Refer to the individual Specification Sections for miscellaneous record keeping requirements and submittals in connection with various construction activities. Submit one paper copy and annotated PDF electronic files and directories of each submittal.

- E. Reports: Submit written report monthly indicating items incorporated into project record documents concurrent with progress of the Work, including revisions, concealed conditions, field changes, product selections, and other notations incorporated.

#### **1.4 PROJECT RECORD DOCUMENT PROCEDURES**

- A. Do not use Project Record Documents for construction purposes. Protect Project Record Documents from deterioration and loss. Provide access to Project Record Documents for Architect's reference.
  - 1. Do not use As Built Drawings and Specifications for Record Drawings and Specifications.
- B. Recording Procedures: Update drawings and specifications on daily bases to record actual conditions. Record information concurrently with construction progress. Do not conceal Work until required information is accurately recorded.
- C. Store Record Documents and samples apart from as built documents used for construction.
  - 1. Label and file Record Documents and samples in accordance with section number listings in Table of Contents. Label each document PROJECT RECORD in neat, large, printed letters.
  - 2. Maintain Record Documents in clean, dry and legible condition.
  - 3. Make Record Documents and samples available for inspection upon request of Architect.

### **PART 2 PRODUCTS**

#### **2.1 RECORD DRAWINGS**

- A. Record Prints: Maintain one set of marked up paper copies of the Contract Drawings and Shop Drawings.
  - 1. Preparation: Mark record prints to show the actual installation where installation varies from that shown originally. Require individual or entity who obtained record data, whether individual or entity is Installer, subcontractor, or similar entity, to provide information for preparation of corresponding marked up record prints. Show actual installation conditions where installation varies from that shown originally.
    - a. Give attention to information on concealed elements difficult to identify or measure and record later.
    - b. Accurately record information in an acceptable drawing technique.
    - c. Record data as soon as possible after obtaining it.
    - d. Record and check the markup before enclosing concealed installations.
    - e. Cross reference record prints to corresponding shop drawings or archive photographic documentation.
  - 2. Content: Types of items requiring marking include, but are not limited to, the following:
    - a. Dimensional changes to Drawings.
    - b. Revisions to details shown on Drawings.
    - c. Depths of foundations below first floor.
    - d. Locations and depths of underground utilities.
    - e. Revisions to routing of piping and conduits.

- f. Revisions to electrical circuitry.
  - g. Actual equipment locations.
  - h. Duct size and routing.
  - i. Locations of concealed internal utilities.
  - j. Changes made by Change Order or Construction Change Directive.
  - k. Changes made following Architect's written orders.
  - l. Details not on the original Contract Drawings.
  - m. Field records for variable and concealed conditions.
  - n. Record information on the Work that is shown only schematically.
3. Mark the Contract Drawings and Shop Drawings completely and accurately. Utilize personnel proficient at recording graphic information in production of marked up record prints.
4. Mark record sets with erasable, red colored pencil. Use colors to distinguish between changes for different categories of the Work at same location.
5. Mark important additional information that was either shown schematically or omitted from original Drawings.
6. Note Construction Change Directive numbers, alternate numbers, Change Order numbers, and similar identification, where applicable.
- B. Record Digital Data Files: Immediately before inspection for Certificate of Substantial Completion, review marked up record prints with Architect. When authorized, prepare full set of corrected digital data files of the Contract Drawings:
- 1. Format: Same digital data software program, version, and operating system as the original Contract Drawings and annotated PDF electronic file with comment function enabled.
  - 2. Incorporate changes and additional information previously marked on record prints. Delete, redraw, and add details and notations where applicable.
  - 3. Refer instances of uncertainty to Architect for resolution.
  - 4. Architect will furnish Contractor one set of digital data files of the Contract Drawings for use in recording information.
    - a. Refer to Section 01 33 00 for requirements related to use of Architect's digital data files.
    - b. Architect will provide data file layer information. Record markups in separate layers.
- C. Newly Prepared Record Drawings: Prepare new Drawings instead of preparing record Drawings where Architect determines that neither the original Contract Drawings nor Shop Drawings are suitable to show actual installation.
- 1. New Drawings may be required when a Change Order is issued as a result of accepting an alternate, substitution, or modification.

2. Consult Architect for proper scale and scope of detailing and notations required to record the actual physical installation and its relation to other construction. Integrate newly prepared record Drawings into record Drawing sets; comply with procedures for formatting, organizing, copying, binding, and submitting.
- D. Format: Identify and date each record Drawing; include the designation PROJECT RECORD DRAWING in a prominent location.
1. Record Prints: Organize record prints and newly prepared record Drawings into manageable sets. Bind each set with durable paper cover sheets. Include identification on cover sheets.
  2. Format: Annotated PDF electronic file with comment function enabled.
  3. Record Digital Data Files: Organize digital data information into separate electronic files that correspond to each sheet of the Contract Drawings. Name each file with the sheet identification. Include identification in each digital data file.
  4. Identification: As follows:
    - a. Project name.
    - b. Date.
    - c. Designation PROJECT RECORD DRAWINGS.
    - d. Name of Architect.
    - e. Name of Contractor.

## **2.2 RECORD SPECIFICATIONS**

- A. Preparation: Mark Specifications to indicate the actual product installation where installation varies from that indicated in Specifications, addenda, and contract modifications. Indicate actual product installation where installation varies from that indicated in Specifications.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.
  2. Mark copy with the proprietary name and model number of products, materials, and equipment furnished, including substitutions and product options selected.
  3. Record the name of manufacturer, supplier, Installer, and other information necessary to provide a record of selections made.
  4. For each principal product, indicate whether record Product Data has been submitted in operation and maintenance manuals instead of submitted as record Product Data.
  5. Note related Change Orders, record Product Data, and record Drawings where applicable.
- B. Format: Submit record Specifications as annotated PDF electronic file and marked up paper copy of Specifications.

## **2.3 RECORD PRODUCT DATA**

- A. Preparation: Mark Product Data to indicate the actual product installation where installation varies substantially from that indicated in Product Data submittal.
1. Give particular attention to information on concealed products and installations that cannot be readily identified and recorded later.

2. Include significant changes in the product delivered to Project site and changes in manufacturer's written instructions for installation.
  3. Note related Change Orders, record Specifications, and record Drawings where applicable.
- B. Format: Submit record Product Data as annotated PDF electronic file. Include record Product Data directory organized by Specification Section number and title, electronically linked to each item of record Product Data.

## **2.4 RECORD SAMPLES**

- A. Record Samples: Determine with Architect and Owner which submitted Samples are to be maintained as Record Samples. Maintain and mark one set to indicate date of review and approval by Architect; note any deviations or variations between reviewed sample and installed product or material.

## **2.5 MISCELLANEOUS RECORD SUBMITTALS**

- A. Assemble miscellaneous records required by the individual Specification Sections for miscellaneous record keeping and submittal in connection with actual performance of the Work. Bind or file miscellaneous records and identify each, ready for continued use and reference. Include the following:
1. Reviewed shop drawings, product data, and samples.
  2. Field test reports.
  3. Inspection certificates and manufacturer's certificates.
  4. Inspections by authorities having jurisdiction (AHJ).
  5. Documentation of foundation depths.
  6. Special measurements or adjustments.
  7. Tests and inspections.
  8. Surveys.
  9. Design mixes.
- B. Format: Submit miscellaneous record submittals as scanned PDF electronic file(s) of marked up miscellaneous record submittals. Include miscellaneous record submittals directory organized by Specification Section number and title, electronically linked to each item of miscellaneous record submittals.

## **PART 3 EXECUTION**

### **3.1 RECORDING AND MAINTENANCE**

- A. Recording: Maintain one copy of each submittal during the construction period for project record document purposes. Post changes and revisions to project record documents as they occur; do not wait until end of Project.
- B. Maintenance of Record Documents and Samples: Store record documents and Samples in the field office apart from the Contract Documents used for construction. Do not use project record documents for construction. Maintain record documents in good order and in a clean, dry, legible condition, protected from deterioration and loss. Provide access to project record documents for Architect's reference during normal working hours.

**END OF SECTION 01 78 39**

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**SECTION 01 88 13**

**SPECIAL CONSTRUCTION PERFORMANCE REQUIREMENTS**

**PART 1 GENERAL**

**1.1 SUMMARY**

A. Section Includes:

1. Digital submittal of Shop Drawings and Product Data related to Texas Department of Insurance (TDI) windstorm requirements and engineered calculations for these products.

B. Related Requirements:

1. Document CA - General Conditions of the Contract for Construction
2. Document CB - Supplementary Conditions to the Contract for Construction
3. Section 01 33 00 - Submittal Procedures

**1.2 QUALITY ASSURANCE**

- A. The Owner will engage a third party Texas Licensed Professional Engineer to provide submittal review and field inspection services related to all windstorm products.

**1.3 SUBMITTAL REQUIREMENTS**

- A. Submit shop drawing and product data as soon as practicable after award of contract but not later than 30 days before dates reviewed submittals will be needed. To avoid delay the contractor should review each submittal to ensure complete and accurate information, especially related to engineering calculations or proof of compliance by an acceptable TDI standard. The type of fastener with load resistant data should be provided along with spacing of fasteners.

**PART 2 PRODUCTS**

**2.1 WINDSTORM RELATED SUBMITTALS**

- A. All windstorm related shop drawings and submittals shall have a TDI certification of that product specific to the project or engineered calculations to indicate compliance. It is the Contractors responsibility to engage a Texas Licensed Professional Engineer during the submittal process for these documents to be reviewed by the windstorm engineer. The list of common windstorm submittals include, but are not limited to the following:
1. MEP roof equipment and curbs
  2. Cold form metal framing
  3. Masonry
  4. Louvers
  5. Exterior Doors and hardware
  6. Exterior storefront and glazing
  7. Wood blocking
  8. All clips and fasteners for attachment

- 9. Others as required by windstorm engineer
- B. The TDI website provides product evaluations for a number of product types with certifications from pre-approved manufacturers. Note that if existing systems are being combined with new then these certifications may not be applicable and specific engineered calculations will be required to indicate compliance.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Contractor shall notify windstorm engineer prior to installation to schedule inspections. The windstorm engineer will review all product installations necessary for the owner to obtain windstorm insurance compliance and provide any direction to contractor for corrective work to comply with windstorm requirements.
- B. Failure by Contractor to schedule inspections by the windstorm engineer at the time of installation will result in non-compliance. It is the Contractor's responsibility to demonstrate that installations which are not inspected are in compliance. If not in compliance, contractor is responsible for all costs associated with attaining compliance, including the removal of finished work and re-installation. All costs associated with demonstration of compliance shall be borne by the Contractor.

**END OF SECTION 01 88 13**

**SECTION 02 41 00**

**DEMOLITION**

**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 SECTION INCLUDES**

- A. Building demolition excluding removal of hazardous materials and toxic substances.
- B. Selective demolition of built site elements.
- C. Selective demolition of building elements for alteration purposes.
- D. Abandonment and removal of existing utilities and utility structures.

**1.3 RELATED REQUIREMENTS**

- A. Section 00 31 00 - Available Project Information: Existing building survey conducted by Owner; information about known hazardous materials.
- B. Section 01 10 00 - Summary of Work : Limitations on Contractor's use of site and premises.
- C. Section 01 10 00 - Summary of Work: Description of items to be salvaged or removed for re-use by Contractor.
- D. Section 01 50 00 - Temporary Facilities and Controls: Site fences, security, protective barriers, and waste removal.
- E. Section 01 60 00 - Product Requirements: Handling and storage of items removed for salvage and relocation.
- F. Section 01 70 00 - Execution and Closeout Requirements: Project conditions; protection of bench marks, survey control points, and existing construction to remain; reinstallation of removed products; temporary bracing and shoring.
- G. Section 01 77 00 - Construction Waste Management and Disposal : Limitations on disposal of removed materials; requirements for recycling.

**1.4 REFERENCE STANDARDS**

- A. 29 CFR 1926 - U.S. Occupational Safety and Health Standards; current edition.
- B. NFPA 241 - Standard for Safeguarding Construction, Alteration, and Demolition Operations; 2019.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Site Plan: Showing:
  - 1. Vegetation to be protected.
  - 2. Areas for temporary construction and field offices.
  - 3. Areas for temporary and permanent placement of removed materials.

- C. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
  - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences.
  - 2. Identify demolition firm and submit qualifications.
  - 3. Include a summary of safety procedures.
- D. Project Record Documents: Accurately record actual locations of capped and active utilities and subsurface construction.

## **1.6 QUALITY ASSURANCE**

- A. Demolition Firm Qualifications: Company specializing in the type of work required.
  - 1. Minimum of 5 years of documented experience.

## **PART 2 PRODUCTS -- NOT USED**

## **PART 3 EXECUTION**

### **3.1 SCOPE**

- A. Remove items indicated on drawings.
- B. Remove other items indicated, for salvage, relocation, and recycling.

### **3.2 GENERAL PROCEDURES AND PROJECT CONDITIONS**

- A. Comply with other requirements specified in Section 01 70 00.
- B. Comply with applicable codes and regulations for demolition operations and safety of adjacent structures and the public.
  - 1. Obtain required permits.
  - 2. Comply with applicable requirements of NFPA 241.
  - 3. Provide, erect, and maintain temporary barriers and security devices.
  - 4. Use physical barriers to prevent access to areas that could be hazardous to workers or the public.
  - 5. Conduct operations to minimize effects on and interference with adjacent structures and occupants.
  - 6. Do not close or obstruct roadways or sidewalks without permit.
- C. Do not begin removal until receipt of notification to proceed from Owner.
- D. Do not begin removal until built elements to be salvaged or relocated have been removed.
- E. Protect existing structures and other elements that are not to be removed.
  - 1. Provide bracing and shoring.
  - 2. Prevent movement or settlement of adjacent structures.

- F. Minimize production of dust due to demolition operations; do not use water if that will result in ice, flooding, sedimentation of public waterways or storm sewers, or other pollution.
- G. If hazardous materials are discovered during removal operations, stop work and notify Architect and Owner; hazardous materials include regulated asbestos containing materials, lead, PCB's, and mercury.
- H. Perform demolition in a manner that maximizes salvage and recycling of materials.
  - 1. Dismantle existing construction and separate materials.
  - 2. Set aside reusable, recyclable, and salvageable materials; store and deliver to collection point or point of reuse.

### **3.3 EXISTING UTILITIES**

- A. Protect existing utilities to remain from damage.
- B. Do not disrupt public utilities without permit from authority having jurisdiction.
- C. Do not close, shut off, or disrupt existing life safety systems that are in use without at least 7 days prior written notification to Owner.
- D. Do not close, shut off, or disrupt existing utility branches or take-offs that are in use without at least 3 days prior written notification to Owner.
- E. Locate and mark utilities to remain; mark using highly visible tags or flags, with identification of utility type; protect from damage due to subsequent construction, using substantial barricades if necessary.
- F. Prepare building demolition areas by disconnecting and capping utilities outside the demolition zone; identify and mark utilities to be subsequently reconnected, in same manner as other utilities to remain.

### **3.4 SELECTIVE DEMOLITION FOR ALTERATIONS**

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
  - 1. Verify that construction and utility arrangements are as indicated.
  - 2. Report discrepancies to Architect before disturbing existing installation.
  - 3. Beginning of demolition work constitutes acceptance of existing conditions that would be apparent upon examination prior to starting demolition.
- B. Separate areas in which demolition is being conducted from other areas that are still occupied.
  - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Remove existing work as indicated and as required to accomplish new work.
  - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
  - 2. Remove items indicated on drawings.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove existing systems and equipment as indicated.

1. Maintain existing active systems that are to remain in operation; maintain access to equipment and 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.
  3. Verify that abandoned services serve only abandoned facilities before removal.
  4. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification.
- E. Protect existing work to remain.
1. Prevent movement of structure; provide shoring and bracing if necessary.
  2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
  3. Repair adjacent construction and finishes damaged during removal work.
  4. Patch as specified for patching new work.

### **3.5 DEBRIS AND WASTE REMOVAL**

- A. Remove debris, junk, and trash from site.
- B. Remove from site all materials not to be reused on site; comply with requirements of Section 01 74 19 - Waste Management.
- C. Leave site in clean condition, ready for subsequent work.
- D. Clean up spillage and wind-blown debris from public and private lands.

**END OF SECTION 02 41 00**

SECTION 03 39 50

CONCRETE SEALING AND DUSTPROOFING

PART 1 - GENERAL

1.1 DESCRIPTION:

- A. Work Included:
  - 1. Application of sealer/dustproofer to existing concrete floor slabs.
- B. Related Work:
  - 1. Section 03 30 00 - Cast-In-Place Concrete

1.2 SUBMITTALS:

- A. Product Data: Manufacturer's complete product information and application instructions.
- B. Certificate: Manufacturer's written certification that proposed products comply with applicable Volatile Organic Compound (VOC) regulations.

1.3 QUALITY ASSURANCE:

- A. Comply with Texas Natural Resources Conservation Commission *Regulation V* regarding VOC content of Architectural coatings. Architectural coatings are protective or decorative coatings applied to interior or exterior of buildings or structures, including latex paint, alkyd paints, stains, lacquers, varnishes, and urethanes.
- B. Apply only when air temperature is between 40°F and 90°F. Allow materials to reach ambient temperature prior to application.
- C. Do not apply sealer to concrete surfaces scheduled to receive adhered floor coverings such as resilient flooring and carpet.

1.4 PRODUCT DELIVERY, STORAGE AND HANDLING:

- A. Deliver materials in factory packaging with tags and labels intact and legible.
- B. Store in a dry, ventilated area protected from freezing.
- C. Carefully handle to prevent spills. Close container after each use.

PART 2 - MATERIALS

2.1 SEALER/DUSTPROOFER:

- A. Sealer/Dustproofer/Densifier for concrete surfaces that produces a clear, high gloss, non-yellowing, slip-resistant penetrating finish.
- B. Acceptable Manufacturers:
  - 1. Basis of Design: Chem Hard, manufactured by L&M Construction Chemicals
  - 2. Other acceptable products/manufacturers: Liqui-Hard, manufactured by W.R. Meadows

PART 3 - EXECUTION

3.1 PREPARATION:

- A. Existing Concrete: Prepare concrete surfaces to be sealed according to sealer manufacturer's recommendations.
  - 1. Completely remove all existing curing compounds, oil, grease, laitance, and other incompatible materials.

2. Apply sealer/dustproofer only to properly cleaned, etched, and thoroughly dried concrete surfaces.

B. Protect adjacent surfaces from overspray, including joint surfaces prior to installation of joint sealant.

3.2 APPLICATION:

A. Apply only to areas where sealed concrete floor finish is scheduled.

B. Apply two uniform coats at 300 sf per gallon each without puddling, according to Manufacturer's written instructions.

C. Apply first coat with a mechanical scrubber. Let first coat dry 6 to 8 hours before applying second coat.

3.3 CLEANING AND PROTECTION:

A. Clean up all debris, containers, and other materials from flooring work. Remove from Owner's property and legally dispose of.

B. Protect sealed surfaces from traffic for at least 8 hours after final coat application.

END OF SECTION



**SECTION 04 01 00**

**MAINTENANCE OF MASONRY**

**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 SECTION INCLUDES**

- A. Water cleaning of masonry surfaces.
- B. Repair of damaged masonry.
- C. Removal and re-installation of brick as indicated on drawings.

**1.3 RELATED REQUIREMENTS**

- A. Section 04 05 11 - Mortar and Masonry Grout.

**1.4 REFERENCE STANDARDS**

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.
  - 1. Require attendance of parties directly affecting work of this section.
  - 2. Review conditions of installation, installation procedures, and coordination with related work.
- B. Scheduling:
  - 1. Perform cleaning and washing of masonry between the hours of 7 am to 11 pm only.

**1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data on cleaning compounds and cleaning solutions.
- C. Manufacturer's Instructions: For cleaning materials, indicate special procedures, conditions requiring special attention.

**1.7 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
  - 1. Maintain one copy of each document on project site.

**1.8 FIELD CONDITIONS**

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

- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.
- C. Do not blast clean or use process creating dust, dirt, when wind is over 10 mph.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Restoration and Cleaning Chemicals:
  - 1. Diedrich Technologies, Inc: [www.diedrichtechnologies.com](http://www.diedrichtechnologies.com).
  - 2. HMK Stone Care System: [www.hmkstonecare.com](http://www.hmkstonecare.com).
  - 3. PROSOCO; Product Sure Klean Vana Trol: [www.prosoco.com](http://www.prosoco.com).

### **2.2 CLEANING MATERIALS**

- A. Cleaning Agent: Detergent type.
- B. Cleaning Agent: 0.5 lb of sodium hydrosulphite mixture to one gallon of water.
- C. Acid Solution: Clean, stain free, commercial hydrochloric (muriatic) acid, mixed one part to 10 parts of potable water.

### **2.3 MORTAR MATERIALS**

- A. Comply with requirements of Section 04 05 11.

### **2.4 MASONRY MATERIALS**

- A. Salvaged brick from existing walls.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that surfaces to be cleaned are ready for work of this section.

### **3.2 PREPARATION**

- A. Protect surrounding elements from damage due to restoration procedures.
- B. Carefully remove and store removable items located in areas to be restored, including fixtures, fittings, finish hardware, and accessories; reinstall upon completion.
- C. Separate areas to be protected from restoration areas using means adequate to prevent damage.
- D. Cover existing landscaping with tarpaulins or similar covers.
- E. Mask immediately adjacent surfaces with material that will withstand cleaning and restoration procedures.
- F. Close off adjacent occupied areas with dust proof and weatherproof partitions.
- G. Protect roof membrane and flashings from damage with 1/2 inch plywood laid on roof surfaces over full extent of work area and traffic route.

- H. When using cleaning methods that involve water or other liquids, install drainage devices to prevent runoff over adjacent surfaces unless those surfaces are impervious to damage from runoff.
- I. Do not allow cleaning runoff to drain into sanitary or storm sewers.

### **3.3 REBUILDING**

- A. Cut out damaged and deteriorated masonry with care in a manner to prevent damage to any adjacent remaining materials.
- B. Support structure as necessary in advance of cutting out units.
- C. Cut away loose or unsound adjoining masonry as directed.
- D. Build in new units following procedures for new work specified in other section(s).
- E. Mortar Mix: Colored and proportioned to match existing work.
- F. Ensure that anchors are correctly located and built in.
- G. Install built in masonry work to match and align with existing, with joints and coursing true and level, faces plumb and in line. Build in all openings, accessories and fittings.

### **3.4 REPOINTING**

- A. Perform repointing prior to cleaning masonry surfaces.
- B. Cut out loose or disintegrated mortar in joints to minimum 1/2 inch depth or until sound mortar is reached.
- C. Use power tools only after test cuts determine no damage to masonry units will result.
- D. Do not damage masonry units.
- E. When cutting is complete, remove dust and loose material by brushing.
- F. Premoisten joint and apply mortar. Pack tightly in maximum 1/4 inch layers. Form a smooth, compact concave joint to match existing.
- G. Moist cure for 72 hours.

### **3.5 CLEANING EXISTING MASONRY**

- A. Cleaning Detergent: Brush clean masonry surfaces at all new masonry locations with cleaning agent in accordance with the manufacturer's instructions. Saturate masonry with clean water and flush loose mortar and dirt.

### **3.6 CLEANING NEW MASONRY**

- A. Verify mortar is fully set and cured.
- B. Clean surfaces and remove large particles with wood scrapers, brass or nylon wire brushes.
- C. Scrub walls with cleaning agent solution using stiff brush. Thoroughly rinse and wash off cleaning solution, dirt and mortar crumbs using clean, pressurized water.
- D. Protect area below cleaning operation and keep masonry soaked with water and flushed free of acid and dissolved mortar continuously for duration of cleaning.

- E. Before solution dries, rinse and remove acid solution and dissolved mortar, using clean, pressurized water.

### **3.7 RESTORATION CLEANING**

- A. Clean surfaces and remove large particles with wood scrapers or non-ferrous wire brush.
- B. Spray coat masonry with restoration cleaner, mixed into solution in accordance with manufacturer's instructions.
- C. Provide a second application if required to match mock-up area.
- D. Allow sufficient time for solution to remain on masonry and agitate with soft fiber brush or sponge.
- E. Rinse from the bottom up with potable water applied at 400 psi and at a rate of 4 gal/min.

### **3.8 CLEANING**

- A. Immediately remove stains, efflorescence, or other excess resulting from the work of this section.
- B. Remove excess mortar, smears, and droppings as work proceeds and upon completion.
- C. Clean surrounding surfaces.

**END OF SECTION 04 01 00**

**SECTION 04 05 11**

**MORTAR AND MASONRY GROUT**

**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 SECTION INCLUDES**

- A. Mortar for masonry.

**1.3 RELATED REQUIREMENTS**

- A. Section 04 01 00 - Maintenance of Masonry: Bedding and pointing mortar for masonry restoration work.

**1.4 REFERENCE STANDARDS**

- A. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.
- B. ASTM C91/C91M - Standard Specification for Masonry Cement; 2018.
- C. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.
- D. ASTM C387/C387M - Standard Specification for Packaged, Dry, Combined Materials for Concrete and High Strength Mortar; 2017.
- E. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
- F. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.
- G. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- H. ASTM C1019 - Standard Test Method for Sampling and Testing Grout for Masonry; 2019.
- I. ASTM C1072 - Standard Test Methods for Measurement of Masonry Flexural Bond Strength; 2019.
- J. ASTM C1142 - Standard Specification for Extended Life Mortar for Unit Masonry; 1995 (Reapproved 2013).
- K. ASTM C1314 - Standard Test Method for Compressive Strength of Masonry Prisms; 2018.
- L. ASTM E518/E518M - Standard Test Methods for Flexural Bond Strength of Masonry; 2015.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Include design mix and indicate whether the Proportion or Property specification of ASTM C270 is to be used. Also include required environmental conditions and admixture limitations.
- C. Samples: Submit two samples of mortar, illustrating mortar color and color range.
- D. Reports: Submit reports on mortar indicating compliance of mortar to property requirements of ASTM C270 and test and evaluation reports per ASTM C780.

- E. Reports: Submit reports on grout indicating compliance of component grout materials to requirements of ASTM C476 and test and evaluation reports to requirements of ASTM C1019.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Manufacturer's Installation Instructions: Submit packaged dry mortar manufacturer's installation instructions.

## **1.6 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
  - 1. Maintain one copy of each document on project site.

## **1.7 PRECONSTRUCTION TESTING**

- A. Testing will be conducted by an independent test agency, in accordance with provisions of Section 01 40 00 - Quality Requirements.
- B. Mortar Mixes: Test mortars prebatched by weight in accordance with ASTM C780 recommendations for preconstruction testing.
  - 1. Test results will be used to establish optimum mortar proportions and establish quality control values for construction testing.
- C. Grout Mixes: Test grout batches in accordance with ASTM C1019 procedures.
  - 1. Test results will be used to establish optimum grout proportions and establish quality control values for construction testing.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Maintain packaged materials clean, dry, and protected against dampness, freezing, and foreign matter.

## **1.9 FIELD CONDITIONS**

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

## **PART 2 PRODUCTS**

### **2.1 MORTAR AND GROUT APPLICATIONS**

- A. Use only factory premixed packaged dry materials for mortar and grout, with addition of water only at project site.
- B. Mortar Color: Custom color as selected by Architect.
- C. Mortar Mix Designs: ASTM C270, Property Specification.
  - 1. Masonry below grade and in contact with earth: Type S.
  - 2. Exterior Masonry Veneer: Type S.
  - 3. Exterior Cavity Walls: Type S mortar with Type N pointing mortar.
  - 4. Exterior, Loadbearing Masonry: Type S.

5. Exterior, Non-loadbearing Masonry: Type N.
6. Exterior Repointing Mortar: Type N with maximum 2 percent ammonium stearate or calcium stearate per cement weight.
7. Interior, Loadbearing Masonry: Type S.
8. Interior, Non-loadbearing Masonry: Type N.
9. Pointing Mortar for Prefaced or Specially Faced Unit Masonry: One part Portland cement, 1/8 part hydrated lime, and two parts graded (80 mesh) aggregate, proportioned by volume. Add aluminum tristearate, calcium stearate, or ammonium stearate equal to 2 percent of Portland cement by weight.

## 2.2 MATERIALS

- A. Packaged Dry Material for Mortar for Unit Masonry: Premixed Portland cement, hydrated lime, and sand; complying with ASTM C387/C387M and capable of producing mortar of the specified strength in accordance with ASTM C270 with the addition of water only.
  1. Type: Type S.
  2. Color: Mineral pigments added as required to produce approved color sample. (Match existing).
  3. Water repellent mortar for use with water repellent masonry units.
  4. Manufacturer:
    - a. Spec Mix, Inc.. Spec Mix PCL; [www.specmix.com](http://www.specmix.com).
    - b. Substitutions: Not permitted.
- B. Pigments for Colored Mortar: Pure, concentrated mineral pigments specifically intended for mixing into mortar and complying with ASTM C979/C979M.
  1. Color(s): To match Architect's sample(s) when incorporated into specified mix design(s).
  2. Manufacturers:
    - a. Davis Colors: [www.daviscolors.com](http://www.daviscolors.com).
    - b. Lambert Corporation: [www.lambertusa.com](http://www.lambertusa.com).
    - c. Solomon Colors: [www.solomoncolors.com](http://www.solomoncolors.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Water: Clean and potable.

## 2.3 MORTAR MIXING

- A. Ready Mixed Mortar: ASTM C1142, Type equivalent to that specified according to ASTM C270.
- B. Thoroughly mix mortar ingredients using mechanical batch mixer, in accordance with ASTM C270 and in quantities needed for immediate use.
- C. Include manufacturer's standard silo system for mixing and delivery of mortar mixes. Shovel measuring is prohibited.

- D. Colored Mortar: Proportion selected pigments and other ingredients to match Architect's sample, without exceeding manufacturer's recommended pigment-to-cement ratio; mix in accordance with manufacturer's instructions, uniform in coloration.
- E. Do not use anti-freeze compounds to lower the freezing point of mortar.
- F. If water is lost by evaporation, re-temper only within two hours of mixing.
- G. Mixing: Mix mortar using manufacturer's standard mechanical mixer to ensure homogeneity and workability. Mix for 4-5 minutes, consistent from batch to batch. Use clean, potable water; add the maximum amount consistent with optimum workability.
  - 1. At the end of the day, thoroughly rinse the mixer to avoid contamination of future mortar batches.
  - 2. Discard mortar 2.5 hours after initial mixing.

### **PART 3 EXECUTION**

#### **3.1 INSTALLATION**

- A. Install mortar to requirements of section(s) in which masonry is specified.

#### **3.2 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field tests, in accordance with provisions of Section 01 40 00 - Quality Requirements.
- B. Test and evaluate mortar in accordance with ASTM C780 procedures.
  - 1. Test with same frequency as specified for masonry units.
- C. Test and evaluate grout in accordance with ASTM C1019 procedures.
  - 1. Test with same frequency as specified for masonry units.
- D. Prism Tests: Test masonry and mortar panels for compressive strength in accordance with ASTM C1314, and for flexural bond strength in accordance with ASTM C1072 or ASTM E518/E518M; perform tests and evaluate results as specified in individual masonry sections.

**END OF SECTION 04 05 11**



**SECTION 04 20 00**

**UNIT MASONRY**

**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 SECTION INCLUDES**

- A. Concrete block.
- B. Reinforcement and anchorage.
- C. Accessories.

**1.3 RELATED REQUIREMENTS**

- A. Section 04 05 11 - Mortar and Masonry Grout.
- B. Section 05 50 00 - Metal Fabrications: Loose steel lintels.

**1.4 REFERENCE STANDARDS**

- A. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- B. ASTM A615/A615M - Standard Specification for Deformed and Plain Carbon-Steel Bars for Concrete Reinforcement; 2020.
- C. ASTM A951/A951M - Standard Specification for Steel Wire for Masonry Joint Reinforcement; 2016, with Editorial Revision (2018).
- D. ASTM A1064/A1064M - Standard Specification for Carbon-Steel Wire and Welded Wire Reinforcement, Plain and Deformed, for Concrete; 2018a.
- E. ASTM C90 - Standard Specification for Loadbearing Concrete Masonry Units; 2016a.
- F. ASTM C129 - Standard Specification for Nonloadbearing Concrete Masonry Units; 2017.
- G. ASTM C140/C140M - Standard Test Methods for Sampling and Testing Concrete Masonry Units and Related Units; 2020a.
- H. ASTM C144 - Standard Specification for Aggregate for Masonry Mortar; 2018.
- I. ASTM C150/C150M - Standard Specification for Portland Cement; 2020.
- J. ASTM C207 - Standard Specification for Hydrated Lime for Masonry Purposes; 2018.
- K. ASTM C270 - Standard Specification for Mortar for Unit Masonry; 2019.
- L. ASTM C404 - Standard Specification for Aggregates for Masonry Grout; 2018.
- M. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
- N. ASTM C780 - Standard Test Method for Preconstruction and Construction Evaluation of Mortars for Plain and Reinforced Unit Masonry; 2020.

- O. ASTM C979/C979M - Standard Specification for Pigments for Integrally Colored Concrete; 2016.
- P. TMS 402/602 - Building Code Requirements and Specification for Masonry Structures; 2016.

#### **1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene a preinstallation meeting one week before starting work of this section; require attendance by all relevant installers.

#### **1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data for masonry units, fabricated wire reinforcement, mortar, and masonry accessories.
- C. Manufacturer's Certificate: Certify that masonry units meet or exceed specified requirements.

#### **1.7 QUALITY ASSURANCE**

- A. Comply with provisions of TMS 402/602, except where exceeded by requirements of Contract Documents.
  - 1. Maintain one copy of each document on project site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section with minimum three years of documented experience.
- C. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

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

### **PART 2 PRODUCTS**

#### **2.1 CONCRETE MASONRY UNITS**

- A. Concrete Block: Comply with referenced standards and as follows:
  - 1. Size: Standard units with nominal face dimensions of 16 by 8 inches and nominal depths as indicated on drawings for specific locations.
  - 2. Special Shapes: Provide non-standard blocks configured for corners, lintels, headers, control joint edges, and other detailed conditions.
  - 3. Load-Bearing Units: ASTM C90, normal weight.
    - a. Hollow block, as indicated.
    - b. Exposed Faces: Manufacturer's standard color and texture where indicated.
  - 4. Non-Loadbearing Units: ASTM C129.
    - a. Hollow block, as indicated.
    - b. Normal weight.

## **2.2 MORTAR AND GROUT MATERIALS**

- A. Mortar and Grout: As specified in Section 04 05 11.

## **2.3 REINFORCEMENT AND ANCHORAGE**

- A. Manufacturers:

1. Blok-Lok Limited: [www.blok-lok.com](http://www.blok-lok.com)
2. Hohmann & Barnard, Inc; Truss Mighty Lok 170-ML: [www.h-b.com](http://www.h-b.com)
3. WIRE-BOND [www.wirebond.com](http://www.wirebond.com)
4. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Reinforcing Steel: ASTM A615/A615M, Grade 60 (60,000 psi), deformed billet bars; galvanized.

- C. Joint Reinforcement: Use ladder type joint reinforcement where vertical reinforcement is involved and truss type elsewhere, unless otherwise indicated.

- D. Single Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss or ladder.
2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B.
3. Size: 0.1875 inch side rods with 0.1875 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

- E. Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss or ladder.
2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B.
3. Size: 0.1875 inch side rods with 0.1875 inch cross rods; width as required to provide not less than 5/8 inch of mortar coverage on each exposure.

- F. Adjustable Multiple Wythe Joint Reinforcement: ASTM A951/A951M.

1. Type: Truss or ladder, with adjustable ties or tabs spaced at 16 in on center.
2. Material: ASTM A1064/A1064M steel wire, hot dip galvanized after fabrication to ASTM A153/A153M, Class B.
3. Size: 0.1875 inch side rods with 0.1875 inch cross rods and adjustable components of 0.1875 inch wire, width of components as required to provide not less than 5/8 inch of mortar coverage from each masonry face.
4. Vertical adjustment: Not more than 1 1/4 inches.
5. Insulation Clips: Provide clips at tabs or ties designed to secure insulation against outer face of inner wythe of masonry.

- G. Strap Anchors: Bent steel shapes, 1-1/2 inch width, 0.105 inch thick, 24 inch length, with 1-1/2 inch long, 90 degree bend at each end to form a U or Z shape or with cross pins, hot dip galvanized to ASTM A153/A153M, Class B.
- H. Flexible Anchors: 2-piece anchors that permit differential movement between masonry and building frame, sized to provide not less than 5/8 inch of mortar coverage from masonry face.
  - 1. Concrete frame: Dovetail anchors of bent steel strap, nominal 1 inch width x 0.024 in thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
  - 2. Steel frame: Crimped wire anchors for welding to frame, 0.25 inch thick, with trapezoidal wire ties 0.1875 inch thick, hot dip galvanized to ASTM A 153/A 153M, Class B.
- I. Two-Piece Wall Ties: Formed steel wire, 0.1875 inch thick, adjustable, eye and pintle type, hot dip galvanized to ASTM A 153/A 153M, Class B, sized to provide not less than 5/8 inch of mortar coverage from masonry face and to allow vertical adjustment of up to 1-1/4 in.

## **2.4 ACCESSORIES**

- A. Joint Filler: Closed cell polyvinyl chloride; oversized 50 percent to joint width; self expanding; in maximum lengths available.
  - 1. Manufacturers:
    - a. Hohmann & Barnard, Inc: [www.h-b.com](http://www.h-b.com)
    - b. WIRE-BOND: [www.wirebond.com](http://www.wirebond.com)
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive masonry.
- B. Verify that related items provided under other sections are properly sized and located.
- C. Verify that built-in items are in proper location, and ready for roughing into masonry work.

### **3.2 PREPARATION**

- A. Direct and coordinate placement of metal anchors supplied for installation under other sections.
- B. Provide temporary bracing during installation of masonry work. Maintain in place until building structure provides permanent bracing.

### **3.3 COLD AND HOT WEATHER REQUIREMENTS**

- A. Maintain materials and surrounding air temperature to minimum 40 degrees F prior to, during, and 48 hours after completion of masonry work.
- B. Maintain materials and surrounding air temperature to maximum 90 degrees F prior to, during, and 48 hours after completion of masonry work.

### **3.4 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 with 4-inch starter block.
  - 3. Mortar Joints: Concave.

### **3.5 PLACING AND BONDING**

- A. Lay hollow masonry units with face shell bedding on head and bed joints.
- B. Buttering corners of joints or excessive furrowing of mortar joints is not permitted.
- C. Remove excess mortar and mortar smears as work progresses.
- D. Remove excess mortar with water repellent admixture promptly. Do not use acids, sandblasting or high pressure cleaning methods.
- E. Interlock intersections and external corners, except for units laid in stack bond.
- F. Do not shift or tap masonry units after mortar has achieved initial set. Where adjustment must be made, remove mortar and replace.
- G. Perform job site cutting of masonry units with proper tools to provide straight, clean, unchipped edges. Prevent broken masonry unit corners or edges.
- H. Cut mortar joints flush where wall tile is scheduled or resilient base is scheduled.
- I. Isolate masonry partitions from vertical structural framing members with a control joint as indicated.
- J. Isolate top joint of masonry partitions from horizontal structural framing members and slabs or decks with compressible joint filler.

### **3.6 REINFORCEMENT AND ANCHORAGE - GENERAL, SINGLE WYTHE MASONRY, AND CAVITY WALL MASONRY**

- A. Unless otherwise indicated on drawings or specified under specific wall type, install horizontal joint reinforcement 16 inches on center.
- B. Place masonry joint reinforcement in first and second horizontal joints above and below openings. Extend minimum 16 inches each side of opening.
- C. Place continuous joint reinforcement in first and second joint below top of walls.
- D. Embed longitudinal wires of joint reinforcement in mortar joint with at least 5/8 inch mortar cover on each side.
- E. Lap joint reinforcement ends minimum 6 inches.
- F. Reinforce stack bonded unit joint corners and intersections with strap anchors 16 inches on center.
- G. Fasten anchors to structural framing and embed in masonry joints as masonry is laid. Unless otherwise indicated on drawings or closer spacing is indicated under specific wall type, space anchors at maximum of 36 inches horizontally and 24 inches vertically.

- H. Embed ties and anchors in mortar joint and extend into masonry unit a minimum of 1-1/2 inches with at least 5/8 inch mortar cover to the outside face of the anchor.

### **3.7 LINTELS**

- A. Install loose steel lintels over openings.

### **3.8 BUILT-IN WORK**

- A. As work progresses, install built-in metal door frames and glazed 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 from framed openings.
- D. Do not build into masonry construction organic materials that are subject to deterioration.

### **3.9 TOLERANCES**

- A. Install masonry within the site tolerances found in TMS 402/602.
- B. Maximum Variation from Alignment of Columns: 1/4 inch.
- C. Maximum Variation From Unit to Adjacent Unit: 1/16 inch.
- D. Maximum Variation from Plane of Wall: 1/4 inch in 10 ft and 1/2 inch in 20 ft or more.
- E. Maximum Variation from Plumb: 1/4 inch per story non-cumulative; 1/2 inch in two stories or more.
- F. Maximum Variation from Level Coursing: 1/8 inch in 3 ft and 1/4 inch in 10 ft; 1/2 inch in 30 ft.
- G. Maximum Variation of Mortar Joint Thickness: Head joint, minus 1/4 inch, plus 3/8 inch.
- H. Maximum Variation from Cross Sectional Thickness of Walls: 1/4 inch.

### **3.10 CUTTING AND FITTING**

- A. Cut and fit for chases, pipes, conduit, sleeves, and grounds. 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.

### **3.11 FIELD QUALITY CONTROL**

- A. An independent testing agency will perform field quality control tests, as specified in Section 01 40 00 - Quality Requirements.
- B. Concrete Masonry Unit Tests: Test each variety of concrete unit masonry in accordance with ASTM C140/C140M for compliance with requirements of this specification.
- C. Mortar Tests: Test each type of mortar in accordance with ASTM C780, testing with same frequency as masonry samples.

**3.12 CLEANING**

- A. Remove excess mortar and mortar droppings.
- B. Replace defective mortar. Match adjacent work.
- C. Clean soiled surfaces with cleaning solution.
- D. Use non-metallic tools in cleaning operations.

**3.13 PROTECTION**

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

**END OF SECTION 04 20 00**

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**SECTION 05 50 00**

**METAL FABRICATIONS**

**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 SECTION INCLUDES**

- A. Shop fabricated steel items.

**1.3 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Placement of metal fabrications in concrete.
- B. Section 09 91 23 - Interior Painting: Paint finish.

**1.4 REFERENCE STANDARDS**

- A. ASTM A36/A36M - Standard Specification for Carbon Structural Steel; 2014.
- B. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2018.
- C. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- D. ASTM A283/A283M - Standard Specification for Low and Intermediate Tensile Strength Carbon Steel Plates; 2018.
- E. ASTM A500/A500M - Standard Specification for Cold-Formed Welded and Seamless Carbon Steel Structural Tubing in Rounds and Shapes; 2020.
- F. ASTM F3125/F3125M - Standard Specification for High Strength Structural Bolts and Assemblies, Steel and Alloy Steel, Heat Treated, Inch Dimensions 120 ksi and 150 ksi Minimum Tensile Strength, and Metric Dimensions 830 MPa and 1040 MPa Minimum Tensile Strength; 2019.
- G. AWS A2.4 - Standard Symbols for Welding, Brazing, and Nondestructive Examination; 2012.
- H. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
- I. IAS AC172 - Accreditation Criteria for Fabricator Inspection Programs for Structural Steel; 2018.
- J. SSPC-Paint 15 - Steel Joist Shop Primer/Metal Building Primer; 1999 (Ed. 2004).
- K. SSPC-Paint 20 - Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic"); 2002 (Ed. 2004).
- L. SSPC-SP 2 - Hand Tool Cleaning; 2018.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate profiles, sizes, connection attachments, reinforcing, anchorage, size and type of fasteners, and accessories. Include erection drawings, elevations, and details where applicable.

1. Indicate welded connections using standard AWS A2.4 welding symbols. Indicate net weld lengths.
- C. Designer's Qualification Statement.
- D. Fabricator's Qualification Statement: Provide documentation showing steel fabricator is accredited under IAS AC172.

## **1.6 QUALITY ASSURANCE**

- A. Design load bearing items 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. Fabricator Qualifications: A qualified steel fabricator that is accredited by IAS AC172.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS - STEEL**

- A. Steel Sections: ASTM A36/A36M.
- B. Steel Tubing: ASTM A500/A500M, Grade B cold-formed structural tubing.
- C. Plates: ASTM A36/A36M.
- D. Pipe: ASTM A53/A53M, Grade B Schedule 40, black finish.
- E. Bolts, Nuts, and Washers: ASTM F3125/F3125M, Type 1, plain.
- F. Welding Materials: AWS D1.1/D1.1M; type required for materials being welded.
- G. Shop and Touch-Up Primer: SSPC-Paint 15, complying with VOC limitations of authorities having jurisdiction.
- H. Touch-Up Primer for Galvanized Surfaces: SSPC-Paint 20, Type I - Inorganic, complying with VOC limitations of authorities having jurisdiction.

### **2.2 FABRICATION**

- A. Fit and shop assemble items in largest practical sections, for delivery to site.
- B. Fabricate items with joints tightly fitted and secured.
- C. Continuously seal joined members by continuous welds.
- D. Grind exposed joints flush and smooth with adjacent finish surface. Make exposed joints butt tight, flush, and hairline. Ease exposed edges to small uniform radius.
- E. Exposed Mechanical Fastenings: Flush countersunk screws or bolts; unobtrusively located; consistent with design of component, except where specifically noted otherwise.
- F. Supply components required for anchorage of fabrications. Fabricate anchors and related components of same material and finish as fabrication, except where specifically noted otherwise.

### **2.3 FABRICATED ITEMS**

- A. Lintels: As detailed; galvanized finish; see drawings for cut-back detail.

## **2.4 FINISHES - STEEL**

- A. Prime paint steel items.
  - 1. Section 05 31 00 - Steel Decking: Bearing plates and angles for metal deck bearing, including anchorage.
  - 2. Exceptions: Do not prime surfaces in direct contact with concrete, where field welding is required, and items to be covered with sprayed fireproofing.
- B. Prepare surfaces to be primed in accordance with SSPC-SP2.
- C. Clean surfaces of rust, scale, grease, and foreign matter prior to finishing.
- D. Prime Painting: One coat.
- E. Galvanizing of Structural Steel Members: Galvanize after fabrication to ASTM A123/A123M requirements.
- F. Galvanizing of Non-structural Items: Galvanize after fabrication to ASTM A123/A123M requirements.

## **2.5 FABRICATION TOLERANCES**

- A. Squareness: 1/8 inch maximum difference in diagonal measurements.
- B. Maximum Offset Between Faces: 1/16 inch.
- C. Maximum Misalignment of Adjacent Members: 1/16 inch.
- D. Maximum Bow: 1/8 inch in 48 inches.
- E. Maximum Deviation From Plane: 1/16 inch in 48 inches.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that field conditions are acceptable and are ready to receive work.

### **3.2 PREPARATION**

- A. Clean and strip primed steel items to bare metal where site welding is required.
- B. Supply setting templates to the appropriate entities for steel items required to be cast into concrete or embedded in masonry.

### **3.3 INSTALLATION**

- A. Install items plumb and level, accurately fitted, free from distortion or defects.
- B. Provide for erection loads, and for sufficient temporary bracing to maintain true alignment until completion of erection and installation of permanent attachments.
- C. Field weld components as indicated on drawings.
- D. Perform field welding in accordance with AWS D1.1/D1.1M.
- E. Obtain approval prior to site cutting or making adjustments not scheduled.

- F. After erection, prime welds, abrasions, and surfaces not shop primed or galvanized, except surfaces to be in contact with concrete.

### **3.4 TOLERANCES**

- A. Maximum Variation From Plumb: 1/4 inch per story, non-cumulative.
- B. Maximum Offset From True Alignment: 1/4 inch.
- C. Maximum Out-of-Position: 1/4 inch.

**END OF SECTION 05 50 00**

**SECTION 06 10 63**

**MISCELLANEOUS ROUGH CARPENTRY**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fire retardant treated wood materials.
- B. Concealed wood blocking, nailers, and supports.

**1.2 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- B. AWPA U1 - Use Category System: User Specification for Treated Wood; 2018.
- C. PS 20 - American Softwood Lumber Standard; 2020.
- D. SPIB (GR) - Grading Rules; 2014.

**1.3 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide technical data on wood preservative materials and application instructions.

**1.4 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.

**1.5 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.

**PART 2 PRODUCTS**

**2.1 GENERAL REQUIREMENTS**

- A. Dimension Lumber: Comply with PS 20 and requirements of specified grading agencies.
  - 1. Species: Southern Pine, unless otherwise indicated.
  - 2. 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.
  - 3. Grading Agency: Grading agency whose rules are approved by the Board of Review, American Lumber Standard Committee ([www.alsc.org](http://www.alsc.org)) and who provides grading service for the species and grade specified; provide lumber stamped with grade mark unless otherwise indicated.

**2.2 DIMENSION LUMBER FOR CONCEALED APPLICATIONS**

- A. Grading Agency: Southern Pine Inspection Bureau, Inc; SPIB (GR).
- B. Sizes: Nominal sizes as indicated on drawings, S4S.

- C. Moisture Content: S-dry or MC19.
- D. Miscellaneous Framing, Blocking, Nailers, Grounds, and Furring:
  - 1. Lumber: S4S, No.2 or Standard Grade.
  - 2. Boards: Standard or No.3.

### **2.3 FACTORY WOOD TREATMENT**

- A. Treated Lumber and Plywood: Comply with requirements of AWWA U1 - Use Category System for wood treatments determined by use categories, expected service conditions, and specific applications.
- B. Fire Retardant Treatment:
  - 1. Interior Type A: AWWA 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. Interior rough carpentry items are to be fire retardant treated.
    - c. Treat rough carpentry items as indicated.
    - d. Do not use treated wood in applications exposed to weather or where the wood may become wet.

## **PART 3 EXECUTION**

### **3.1 PREPARATION**

- A. Coordinate installation of rough carpentry members specified in other sections.

### **3.2 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.

### **3.3 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 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.
- C. Where ceiling-mounting is indicated, provide blocking and supplementary supports above ceiling, unless other method of support is explicitly indicated.
- D. Provide the following specific nonstructural framing and blocking:

1. Cabinets and shelf supports.
2. Wall brackets.
3. Handrails.
4. Grab bars.
5. Towel and bath accessories.
6. Wall-mounted door stops.
7. Chalkboards and marker boards.
8. Wall paneling and trim.
9. Joints of rigid wall coverings that occur between studs.

**END OF SECTION 06 10 63**

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**SECTION 06 20 00**

**FINISH CARPENTRY**

**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 SECTION INCLUDES**

- A. Finish carpentry items.

**1.3 RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting: Painting of finish carpentry items.

**1.4 REFERENCE STANDARDS**

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- B. AWI (QCP) - Quality Certification Program; Current Edition.
- C. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- D. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- E. BHMA A156.9 - American National Standard for Cabinet Hardware; 2015.
- F. HPVA HP-1 - American National Standard for Hardwood and Decorative Plywood; 2016.
- G. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- H. PS 1 - Structural Plywood; 2009.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with plumbing rough-in, electrical rough-in, and installation of associated and adjacent components.
- B. Sequence installation to ensure utility connections are achieved in an orderly and expeditious manner.

**1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data:
  - 1. Provide data on fire retardant treatment materials and application instructions.
  - 2. Provide instructions for attachment hardware and finish hardware.
- C. Shop Drawings: Indicate materials, component profiles, fastening methods, jointing details, and accessories.
  - 1. Scale of Drawings: 1-1/2 inch to 1 foot, minimum.

2. Provide the information required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
  3. Include certification program label.
- D. Samples: Submit two samples of finish plywood, 12x12 inch in size illustrating wood grain and specified finish.
- E. Samples: Submit two samples of wood trim 12 inch long.

#### **1.7 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](http://www.awiqcp.org).

#### **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Store finish carpentry items under cover, elevated above grade, and in a dry, well-ventilated area not exposed to heat or sunlight.
- B. Protect from moisture damage.

### **PART 2 PRODUCTS**

#### **2.1 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:

#### **2.2 LUMBER MATERIALS**

- A. Softwood Lumber: SYP species, plain sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.
- B. Hardwood Lumber: Red Oak species, Quarter sawn sawn, maximum moisture content of 6 percent; with vertical grain, of quality suitable for transparent finish.

#### **2.3 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.

- B. Softwood Plywood, Exposed to View: Face species as indicated, plain sawn, medium density fiberboard core; PS 1 Grade A-B, glue type as recommended for application.
- C. Hardwood Plywood: Face species as indicated, plain sawn, book matched, medium density fiberboard core; HPVA HP-1, Front Face Grade AA, Back Face Grade 1, glue type as recommended for application.

## **2.4 PLASTIC LAMINATE MATERIALS**

- A. Plastic Laminate: NEMA LD 3, HGS; color as selected by Architect; textured, low gloss finish.
- B. Laminate Adhesive: Type recommended by laminate manufacturer to suit application; not containing formaldehyde or other volatile organic compounds.

## **2.5 FASTENINGS**

- A. Adhesive for Purposes Other Than Laminate Installation: Suitable for the purpose; not containing formaldehyde or other volatile organic compounds.
- B. Concealed Joint Fasteners: Threaded steel.

## **2.6 ACCESSORIES**

- A. Primer: Alkyd primer sealer.
- B. Wood Filler: Solvent base, tinted to match surface finish color.

## **2.7 HARDWARE**

- A. Hardware: Comply with BHMA A156.9.

## **2.8 WOOD TREATMENT**

- A. Fire Retardant Treatment (FR-S Type): Chemically treated and pressure impregnated; capable of providing flame spread index of 25, maximum, and smoke developed index of 450, maximum, when tested in accordance with ASTM E84.
- B. Provide identification on fire retardant treated material.
- C. Deliver fire retardant treated materials cut to required sizes. Minimize field cutting.
- D. Kiln dry wood after pressure treatment to maximum 15 percent moisture content.

## **2.9 FABRICATION**

- A. Shop assemble work for delivery to site, permitting passage through building openings.
- B. Fit exposed sheet material edges with 3/8 inch matching hardwood edging. Use one piece for full length only.
- C. Cap exposed plastic laminate finish edges with material of same finish and pattern.
- D. Shop prepare and identify components for book match grain matching during site erection.
- E. When necessary to cut and fit on site, provide materials with ample allowance for cutting. Provide trim for scribing and site cutting.
- F. 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.

- G. Apply laminate backing sheet to reverse face of plastic laminate finished surfaces.

## **2.10 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:
  - 1. Transparent:
    - a. System - 1, Lacquer, Nitrocellulose.
    - b. Stain: As selected by Architect.
    - c. Sheen: Flat.
  - 2. Opaque:
    - a. System - 1, Lacquer, Nitrocellulose.
    - b. Color: As selected by Architect.
    - c. Sheen: Flat.
- E. Back prime woodwork items to be field finished, prior to installation.

## **PART 3 EXECUTION**

### **3.1 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.

### **3.2 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. Do not use additional overlay trim to conceal larger gaps.
- D. Install components with screws at 16 inch on center.
- E. Install hardware in accordance with manufacturer's written instructions.

### **3.3 PREPARATION FOR SITE FINISHING**

- A. Set exposed fasteners. Apply wood filler in exposed fastener indentations. Sand work smooth.

- B. Before installation, prime paint surfaces of items or assemblies to be in contact with cementitious materials.

**END OF SECTION 06 20 00**

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**SECTION 06 83 16**

**FIBERGLASS REINFORCED PANELING**

**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 SECTION INCLUDES**

- A. Fiberglass reinforced plastic panels.
- B. Trim.

**1.3 RELATED REQUIREMENTS**

- A. Section 01 61 16 - (VOC) Content Restrictions.

**1.4 REFERENCE STANDARDS**

- A. 9 CFR 416.2 - Regulatory Requirements Under the Federal Meat Inspection Act and the Poultry Products Inspection Act, Part 416-Sanitation; current edition.
- B. ASTM D256 - Standard Test Methods for Determining the Izod Pendulum Impact Resistance of Plastics; 2010 (Reapproved 2018).
- C. ASTM D2583 - Standard Test Method for Indentation Hardness of Rigid Plastics by Means of Barcol Impressor; 2013a.
- D. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- E. ASTM D5319 - Standard Specification for Glass-Fiber Reinforced Polyester Wall and Ceiling Panels; 2017.
- F. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- G. FM 4880 - Approval Standard for Class 1 Fire Rating of Building Panels or Interior Finish Materials; 2015.
- H. ISO 2812-1 - Paints and varnishes -- Determination of resistance to liquids -- Part 1: Immersion in liquids other than water; 2017.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - 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. Samples: Submit two samples 6x6 inch in size illustrating material and surface design of panels.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Store panels flat, indoors, on a clean, dry surface. Remove packaging and allow panels to acclimate to room temperature for 48 hours prior to installation.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Fiberglass Reinforced Plastic Panels:
  - 1. Crane Composites, Inc: [www.cranecomposites.com](http://www.cranecomposites.com).
  - 2. Marlite: [www.marlite.com](http://www.marlite.com).
  - 3. Nudo: [www.nudo.com](http://www.nudo.com).

### **2.2 PANEL SYSTEMS**

- A. Wall Panels:
  - 1. Panel Size: 4 by 9 feet.
  - 2. Panel Thickness: 0.10 inch.
  - 3. Surface Design: Embossed.
  - 4. Color: As selected by Architect.
  - 5. Attachment Method: Adhesive only, with trim and sealant in joints.

### **2.3 MATERIALS**

- A. Panels: Fiberglass reinforced plastic (FRP), complying with ASTM D5319.
  - 1. Surface Burning Characteristics: Maximum flame spread index of 25 and smoke developed index of 450; when system tested in accordance with ASTM E84.
  - 2. Class 1 fire rated when tested in accordance with FM 4880.
  - 3. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
  - 4. Scratch Resistance: Barcol hardness score greater than 35, when tested in accordance with ASTM D2583.
  - 5. Impact Strength: Greater than 6 ft lb force per inch, when tested in accordance with ASTM D256.
  - 6. Sanitation and Cleanability: Comply with 9 CFR 416.2.
  - 7. Chemical Cleanability: Excellent chemical resistance to common cleaners and detergents when tested in accordance with ISO 2812-1.
- B. Trim: Vinyl; color coordinating with panel.
- C. Adhesive: Type recommended by panel manufacturer.
- D. Sealant: Silicone; color matching panel.



## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions and substrate flatness before starting work.
- B. Verify that substrate conditions are ready to receive the work of this section.
- C. Verify that layout of hangers will not interfere with other work; make adjustments in layout as necessary.
- D. Do not begin ceiling installation until services above ceiling are complete except for final trim

### **3.2 INSTALLATION - WALLS**

- A. Install panels in accordance with manufacturer's instructions.
- B. Cut and drill panels with carbide tipped saw blades, drill bits, or snips.
- C. Apply adhesive to the back side of the panel using trowel as recommended by adhesive manufacturer.
- D. Apply panels to wall with seams plumb and pattern aligned with adjoining panels.
- E. Install panels with manufacturer's recommended gap for panel field and corner joints.
- F. Place trim on panel before fastening edges, as required.
- G. Fill channels in trim with sealant before attaching to panel.
- H. Install trim with adhesive and screws or nails, as required.
- I. Seal gaps at floor, ceiling, and between panels with applicable sealant to prevent moisture intrusion.
- J. Remove excess sealant after paneling is installed and prior to curing.

**END OF SECTION 06 83 16**

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**SECTION 07 05 53**

**FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

**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 SECTION INCLUDES**

- A. Identification markings for fire and smoke rated partitions, and fire rated walls.

**1.3 REFERENCE STANDARDS**

- A. ICC (IBC) - International Building Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

**1.4 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of marking, indicating font, foreground and background colors, wording, and overall dimensions.
- C. Schedule: Completely define scope of proposed marking, and indicate location of affected walls and partitions, and number of markings.
- D. Samples: Submit two samples of each type of marking proposed for use, of size similar to that required for project, illustrating font, wording, and method of application.

**1.5 QUALITY ASSURANCE**

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

**1.6 FIELD CONDITIONS**

- A. Do not install adhered markings when ambient temperature is lower than recommended by label or sign manufacturer.
- B. Do not install painted markings when ambient temperature is lower than recommended by coating manufacturer.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Partition Identification Labels:
  - 1. Fire Wall Signs, Inc: [www.firewallsigns.com](http://www.firewallsigns.com).
  - 2. Safety Supply Warehouse, Inc: [www.safetysupplywarehouse.com](http://www.safetysupplywarehouse.com).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.2 FIRE AND SMOKE ASSEMBLY IDENTIFICATION**

- A. Regulatory Requirements: Comply with "Marking and Identification" requirements of "Fire-Resistance Ratings and Fire Tests" chapter of ICC (IBC).
- B. Adhered Fire and Smoke Assembly Identification Signs: Printed vinyl or paper sign with factory applied adhesive backing.
- C. Languages: Provide sign markings in English.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.2 INSTALLATION**

- A. Locate markings as required by ICC (IBC).
- B. Install adhered markings in accordance with manufacturer's instructions.
- C. Install neatly, with horizontal edges level.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged markings.

**END OF SECTION 07 05 53**

**SECTION 07 21 00**

**THERMAL INSULATION**

**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 SECTION INCLUDES**

- A. Batt insulation in exterior wall and ceiling construction.
- B. Batt insulation for filling perimeter window and door shim spaces and crevices in exterior wall and roof.

**1.3 REFERENCE STANDARDS**

- A. ASTM C578 - Standard Specification for Rigid, Cellular Polystyrene Thermal Insulation; 2019.
- B. ASTM C665 - Standard Specification for Mineral-Fiber Blanket Thermal Insulation for Light Frame Construction and Manufactured Housing; 2017.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.

**1.4 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide data on product characteristics, performance criteria, and product limitations.
- C. Manufacturer's Installation Instructions: Include information on special environmental conditions required for installation and installation techniques.

**1.5 FIELD CONDITIONS**

- A. Do not install insulation adhesives when temperature or weather conditions are detrimental to successful installation.

**PART 2 PRODUCTS**

**2.1 APPLICATIONS**

- A. Insulation in Metal Framed Walls: Batt insulation with no vapor retarder.

**2.2 BATT INSULATION MATERIALS**

- A. Mineral Fiber Batt Insulation: (Safing): Flexible or semi-rigid preformed batt or blanket, complying with ASTM C665; friction fit; unfaced flame spread index of 0 (zero) when tested in accordance with ASTM E84.
  - 1. Flame Spread Index: 25 or less, when tested in accordance with ASTM E84.
  - 2. Smoke Developed Index: 0 (zero), when tested in accordance with ASTM E84.
  - 3. Thickness: as indicated on drawings.
  - 4. Products:

- a. Johns Manville; MinWool Sound Attenuation Fire Batts: [www.jm.com](http://www.jm.com).
- b. Knauf Insulation; EcoBatt Insulation: [www.knaufinsulation.com](http://www.knaufinsulation.com).
- c. ROCKWOOL (ROXUL, Inc); AFB evo™: [www.rockwool.com](http://www.rockwool.com).
- d. Thermafiber, Inc; SAFB FF: [www.thermafiber.com](http://www.thermafiber.com).
- e. Substitutions: See Section 01 60 00 - Product Requirements.

### 2.3 ACCESSORIES

- A. Insulation Fasteners: Lengths of unfinished, 13 gauge, 0.072 inch high carbon spring steel with chisel or mitered tips, held in place by tension, length to suit insulation thickness and substrate, capable of securely supporting insulation in place.
- B. Insulation Fasteners: Impaling clip of unfinished steel with washer retainer and clips, to be adhered to surface to receive insulation, length to suit insulation thickness and substrate, capable of securely and rigidly fastening insulation in place.
- C. ***Insulation Fasteners: Appropriate for purpose intended and approved by Factory Mutual and roofing manufacturer.***
  - 1. ***Length as required for thickness of insulation material and penetration of deck substrate, with metal washers.***

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify that substrate, adjacent materials, and insulation materials are dry and that substrates are ready to receive insulation.
- B. Verify substrate surfaces are flat, free of honeycomb, fins, irregularities, or materials or substances that may impede adhesive bond.

### 3.2 BATT INSTALLATION

- A. Install insulation in accordance with manufacturer's instructions.
- B. Install in exterior wall spaces without gaps or voids. Do not compress insulation.
- C. Trim insulation neatly to fit spaces. Insulate miscellaneous gaps and voids.
- D. Fit insulation tightly in cavities and tightly to exterior side of mechanical and electrical services within the plane of the insulation.
- E. Retain insulation batts in place with spindle fasteners at 12 inches on center.

### 3.3 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.

### 3.4 PROTECTION

- A. Do not permit installed insulation to be damaged prior to its concealment.

**END OF SECTION 07 21 00**

**SECTION 07 21 19**

**FOAMED-IN-PLACE INSULATION**

**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 SECTION INCLUDES**

- A. Foamed-in-place insulation.
  - 1. As indicated on drawings.
  - 2. In exterior framed walls.
  - 3. In exterior wall crevices.

**1.3 REFERENCE STANDARDS**

- A. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2017.
- B. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
- C. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- D. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- E. ASTM E2178 - Standard Test Method for Air Permeance of Building Materials; 2013.

**1.4 ADMINISTRATIVE REQUIREMENTS**

- A. Preinstallation Meeting: Convene one week prior to commencing work of this section.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, insulation properties, overcoat properties, and preparation requirements.
- C. Certificates: Certify that products of this section meet or exceed specified requirements.
- D. Manufacturer's Installation Instructions: Indicate special procedures, and perimeter conditions requiring special attention.

**1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with not less than three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified, with minimum three years documented experience, and approved by manufacturer.
- C. Air Barrier Association of America (ABAA) Quality Assurance Program (QAP); [www.airbarrier.org/#sle](http://www.airbarrier.org/#sle):

1. Installer Qualification: Use accredited contractor, certified installers, evaluated materials, and third-party field quality control audit.
2. Manufacturer Qualification: Use evaluated materials from a single manufacturer regularly engaged in air barrier material manufacture. Use secondary materials approved in writing by primary material manufacturer.

## **1.7 FIELD CONDITIONS**

- A. Do not apply foam when temperature is below that specified by the manufacturer for ambient air and substrate.
- B. Do not apply foam when temperature is within 5 degrees F of dew point.

## **PART 2 PRODUCTS**

### **2.1 MATERIALS**

- A. Foamed-In-Place Insulation: Medium-density, rigid or semi-rigid, open or closed cell polyurethane foam; foamed on-site, using blowing agent of water or non-ozone-depleting gas.
  1. Regulatory Requirements: Comply with applicable code for flame and smoke, concealment, and overcoat limitations.
  2. Thermal Resistance: R-value of 5.0, minimum, per 1 inch thickness at 75 degrees F mean temperature when tested in accordance with ASTM C518.
  3. Water Vapor Permeance: Vapor retarder; 2 perms, maximum, when tested at intended thickness in accordance with ASTM E96/E96M, desiccant method.
  4. Water Absorption: Less than 2 percent by volume, maximum, when tested in accordance with ASTM D2842.
  5. Air Permeance: 0.04 cfm per square foot, maximum, when tested at intended thickness in accordance with ASTM E2178 at 1.57 psf.
  6. Closed Cell Content: At least 90 percent.
  7. Surface Burning Characteristics: Flame spread/Smoke developed index of 25/450, maximum, when tested in accordance with ASTM E84.
  8. Basis of Design:
    - a. Icynene-Lapolla; Icynene ProSeal LE: [www.icynene.com](http://www.icynene.com).
  9. Other Acceptable Manufacturers:
    - a. Gaco Western; GacoOnePass F1850R: [www.gaco.com](http://www.gaco.com).
    - b. Johns Manville; JM Corbond III Closed Cell Spray Polyurethane Foam: [www.jm.com](http://www.jm.com).

### **2.2 ACCESSORIES**

- A. Primer: As required by insulation manufacturer.



## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify work within construction spaces or crevices is complete prior to insulation application.
- B. Verify that surfaces are clean, dry, and free of matter that may inhibit insulation or overcoat adhesion.

### **3.2 PREPARATION**

- A. Mask and protect adjacent surfaces from over spray or dusting.
- B. Apply primer in accordance with manufacturer's instructions.

### **3.3 APPLICATION**

- A. Apply insulation in accordance with manufacturer's instructions.
- B. Apply insulation by spray method, to a uniform monolithic density without voids.
- C. Patch damaged areas.
- D. Where applied to voids and gaps assure space for expansion to avoid pressure on adjacent materials that may bind operable parts.
- E. Trim excess away for applied trim or remove as required for continuous sealant bead.

### **3.4 FIELD QUALITY CONTROL**

- A. Field inspections and tests will be performed by an independent testing agency under provisions of Section 01 40 00 - Quality Requirements.
- B. Inspection will include verification of insulation and overcoat thickness and density.
- C. Coordination of ABAA Tests and Inspections:
  - 1. Provide testing and inspection required by ABAA QAP.
  - 2. Notify in ABAA writing of schedule for air barrier work. Allow adequate time for testing and inspection.
  - 3. Cooperate with ABAA testing agency.
  - 4. Allow access to air barrier work areas and staging.
  - 5. Do not cover air barrier work until tested, inspected, and accepted.

### **3.5 PROTECTION**

- A. Do not permit subsequent construction work to disturb applied insulation.

**END OF SECTION 07 21 19**

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**SECTION 07 84 00**

**FIRESTOPPING**

**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 SECTION INCLUDES**

- A. Firestopping systems.
- B. Firestopping of joints and penetrations in fire-resistance-rated and smoke-resistant assemblies, whether indicated on drawings or not, and other openings indicated.

**1.3 RELATED REQUIREMENTS**

- A. Section 01 70 00 - Execution and Closeout Requirements: Cutting and patching.
- B. Section 07 05 53 - Fire and Smoke Assembly Identification.

**1.4 REFERENCE STANDARDS**

- A. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials; 2020.
- B. ASTM E814 - Standard Test Method for Fire Tests of Penetration Firestop Systems; 2013a (Reapproved 2017).
- C. ASTM E1966 - Standard Test Method for Fire-Resistive Joint Systems; 2015 (Reapproved 2019).
- D. ASTM E2174 - Standard Practice for On-Site Inspection of Installed Firestop Systems; 2020a.
- E. ASTM E2393 - Standard Practice for On-Site Inspection of Installed Fire Resistive Joint Systems and Perimeter Fire Barriers; 2020.
- F. ASTM E2307 - Standard Test Method for Determining Fire Resistance of Perimeter Fire Barriers Using Intermediate-Scale, Multi-story Test Apparatus; 2020.
- G. ASTM E2837 - Standard Test Method for Determining the Fire Resistance of Continuity Head-of-Wall Joint Systems Installed Between Rated Wall Assemblies and Nonrated Horizontal Assemblies; 2013 (Reapproved 2017).
- H. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.
- I. ITS (DIR) - Directory of Listed Products; current edition.
- J. FM 4991 - Approval Standard for Firestop Contractors; 2013.
- K. FM (AG) - FM Approval Guide; current edition.
- L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- M. UL 1479 - Standard for Fire Tests of Penetration Firestops; Current Edition, Including All Revisions.
- N. UL 2079 - Standard for Tests for Fire Resistance of Building Joint Systems; Current Edition, Including All Revisions.

- O. UL (DIR) - Online Certifications Directory; Current Edition.
- P. UL (FRD) - Fire Resistance Directory; Current Edition.

## **1.5 SUBMITTALS**

- A. See Section 01 33 00 - Submittal Procedures.
- B. Schedule of Firestopping: List each type of penetration, fire rating of the penetrated assembly, and firestopping test or design number.
- C. Product Data: Provide data on product characteristics, performance ratings, and limitations.
- D. Sustainable Design Submittal: Submit VOC content documentation for nonpreformed materials.
- E. Manufacturer's Installation Instructions: Indicate preparation and installation instructions.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Certificate from authority having jurisdiction indicating approval of materials used.
- H. Manufacturer's qualification statement.
- I. Installer's qualification statement.

## **1.6 QUALITY ASSURANCE**

- A. Fire Testing: Provide firestopping assemblies of designs that provide the scheduled fire ratings when tested in accordance with methods indicated.
  - 1. Listing in UL (FRD), FM (AG), or ITS (DIR) will be considered as constituting an acceptable test report.
  - 2. Valid evaluation report published by ICC Evaluation Service, Inc. (ICC-ES) at [www.icc-es.org](http://www.icc-es.org) will be considered as constituting an acceptable test report.
  - 3. Submission of actual test reports is required for assemblies for which none of the above substantiation exists.
- 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:
  - 1. Trained by manufacturer.
  - 2. Approved by Factory Mutual Research Corporation under FM 4991, or meeting any two of the following requirements:
  - 3. Verification of minimum three years documented experience installing work of this type.
  - 4. Verification of at least five satisfactorily completed projects of comparable size and type.
  - 5. Licensed by local authorities having jurisdiction (AHJ).

## **1.7 MOCK-UP**

- A. Install one firestopping assembly representative of each fire rating design required on project.

1. Where one design may be used for different penetrating items or in different wall constructions, install one assembly for each different combination.
  2. Where firestopping is intended to fill a linear opening, install minimum of 1 linear ft.
- B. Obtain approval of authorities having jurisdiction (AHJ) before proceeding.
- C. If accepted, mock-up will represent minimum standard for this work.
- D. If accepted, mock-up may remain as part of this work. Remove and replace mock-ups not accepted.

## **1.8 FIELD CONDITIONS**

- A. Comply with firestopping manufacturer's recommendations for temperature and conditions during and after installation; maintain minimum temperature before, during, and for three days after installation of materials.
- B. Provide ventilation in areas where solvent-cured materials are being installed.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Firestopping Manufacturers:
1. 3M Fire Protection Products: [www.3m.com/firestop](http://www.3m.com/firestop).
  2. A/D Fire Protection Systems Inc: [www.adfire.com](http://www.adfire.com).
  3. Hilti, Inc: [www.us.hilti.com](http://www.us.hilti.com).
  4. Nelson FireStop Products: [www.nelsonfirestop.com](http://www.nelsonfirestop.com).
  5. Specified Technologies Inc: [www.stifirestop.com](http://www.stifirestop.com).
  6. Tremco Commercial Sealants & Waterproofing: [www.tremcosealants.com](http://www.tremcosealants.com).

### **2.2 MATERIALS**

- A. Firestopping Materials: Any materials meeting requirements.
- B. Volatile Organic Compound (VOC) Content: Provide products having VOC content lower than that required by SCAQMD 1168.
- C. Mold and Mildew Resistance: Provide firestoppping materials with mold and mildew resistance rating of zero(0) in accordance with ASTM G21.
- D. Primers, Sleeves, Forms, Insulation, Packing, Stuffing, and Accessories: Provide type of materials as required for tested firestopping assembly.
- E. Fire Ratings: Refer to drawings for required systems and ratings.

### **2.3 FIRESTOPPING ASSEMBLY REQUIREMENTS**

- A. Perimeter Fire Containment Firestopping: Use system that has been tested according to ASTM E2307 to have fire resistance F Rating equal to required fire rating of floor assembly.
1. Movement: Provide systems that have been tested to show movement capability as indicated.

2. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
  3. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  4. Where floor assembly is not required to have a fire rating, provide systems that have been tested to show L Rating as indicated.
- B. Head-of-Wall (HW) Joint System Firestopping at Joints Between Fire-Rated Wall Assemblies and Non-Rated Horizontal Assemblies: Use system that has been tested according to ASTM E2837 to have fire resistance F Rating equal to required fire rating of wall assembly.
1. Movement: Provide systems that have been tested to show movement capability as indicated.
- C. Floor-to-Floor (FF), Floor-to-Wall (FW), Head-of-Wall (HW), and Wall-to-Wall (WW) Joints, Except Perimeter, Where Both Are Fire-Rated: Use system that has been tested according to ASTM E1966 or UL 2079 to have fire resistance F Rating equal to required fire rating of the assembly in which the joint occurs.
1. Movement: Provide systems that have been tested to show movement capability as indicated.
  2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
  4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.
- D. Through Penetration Firestopping: Use system that has been tested according to ASTM E814 to have fire resistance F Rating equal to required fire rating of penetrated assembly.
1. Temperature Rise: Provide systems that have been tested to show T Rating as indicated.
  2. Air Leakage: Provide systems that have been tested to show L Rating as indicated.
  3. Watertightness: Provide systems that have been tested to show W Rating as indicated.
  4. Listing by FM (AG), ITS (DIR), UL (DIR), or UL (FRD) in their certification directories will be considered evidence of successful testing.

## **2.4 FIRESTOPPING FOR FLOOR-TO-FLOOR, FLOOR-TO-WALL, HEAD-OF-WALL, AND WALL-TO-WALL JOINTS**

- A. Gypsum Board Walls:
1. Wall-to-Wall Joints That Have Not Been Tested For Movement Capabilities (Static-S):
    - a. 1 Hour Construction: UL System WW-S-0063; Specified Technologies Inc. SpeedFlex TTG Track Top Gasket.
  2. Wall-to-Wall Joints That Have Movement Capabilities (Dynamic-D):
    - a. 1 Hour Construction: UL System WW-D-0067; Hilti CP 606 Flexible Firestop Sealant.
  3. Head-of-Wall Joints at Underside of Steel Beam and Concrete Over Metal Deck Floor with Sprayed On Fireproofing:
    - a. 1 Hour Construction: UL System HW-D-0259; Hilti CFS-SP WB Firestop Joint Spray and CP 672.

## **2.5 FIRESTOPPING FOR FLOOR-TO-WALL MOVABLE JOINTS**

### **A. Floor-To-Wall Joint System That Have Movement Capabilities (Dynamic-D):**

1. 2 Hour Construction: UL System FW-D-1069; Tremco, TREMstop Acrylic Firestop Sealant.

## **2.6 FIRESTOPPING PENETRATIONS THROUGH CONCRETE AND CONCRETE MASONRY CONSTRUCTION**

### **A. Penetrations Through Floors or Walls By:**

1. Insulated Pipes:
  - a. 2 Hour Construction: UL System C-AJ-5313; Specified Technologies Inc. LC Endothermic Firestop Sealant.
2. HVAC Ducts, Uninsulated:
  - a. 2 Hour Construction: UL System C-AJ-7111; Hilti FS-ONE MAX Intumescent Firestop Sealant.

### **B. Penetrations Through Floors By:**

1. Insulated Pipes:
  - a. 2 Hour Construction: UL System F-A-5045; Specified Technologies Inc. CID cast-in devices.

### **C. Penetrations Through Walls By:**

1. Insulated Pipes:
  - a. 1 Hour Construction: UL System C-AJ-5091; Hilti FS-ONE MAX Intumescent Firestop Sealant.
2. HVAC Ducts, Insulated:
  - a. 2 Hour Construction: UL System W-J-7112; Hilti FS-ONE MAX Intumescent Firestop Sealant.

## **2.7 FIRESTOPPING PENETRATIONS THROUGH GYPSUM BOARD WALLS**

### **A. Penetrations By:**

1. Uninsulated Metallic Pipe, Conduit, and Tubing:
  - a. 1 Hour Construction: UL System W-L-1042; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
2. Uninsulated Non-Metallic Pipe, Conduit, and Tubing:
  - a. 1 Hour Construction: UL System W-L-2241; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).
3. Cable Trays with Electrical Cables:
  - a. 1 Hour Construction: UL System W-L-4060; Hilti FS-ONE MAX Intumescent Firestop Sealant.
4. Insulated Pipes:
  - a. 1 Hour Construction: UL System W-L-5298; Specified Technologies Inc. WF300 Intumescent Firestop Caulk (for wood frame construction).

5. HVAC Ducts, Insulated:

- a. 1 Hour Construction: UL System W-L-7156; Hilti FS-ONE MAX Intumescent Firestop Sealant.

**2.8 FIRESTOPPING SYSTEMS**

- A. Fire Ratings: Use system that is listed by FM (AG), ITS (DIR), or UL (FRD) and tested in accordance with ASTM E814, ASTM E119, or UL 1479 with F Rating equal to fire rating of penetrated assembly and minimum T Rating Equal to F Rating and in compliance with other specified requirements.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify openings are ready to receive the work of this section.

**3.2 PREPARATION**

- A. Clean substrate surfaces of dirt, dust, grease, oil, loose material, or other materials that could adversely affect bond of firestopping material.
- B. Remove incompatible materials that could adversely affect bond.
- C. Install backing materials to prevent liquid material from leakage.

**3.3 INSTALLATION**

- A. Install materials in manner described in fire test report and in accordance with manufacturer's instructions, completely closing openings.
- B. Do not cover installed firestopping until inspected by Owner's Independent Testing Agency.
- C. Do not cover installed firestopping until inspected by authorities having jurisdiction.
- D. Install labeling required by code.

**3.4 FIELD QUALITY CONTROL**

- A. Independent Testing Agency: Inspection agency employed and paid by Owner, will examine penetration firestopping in accordance with ASTM E2174, and ASTM E2393.
- B. Repair or replace penetration firestopping and joints at locations where inspection results indicate firestopping or joints do not meet specified requirements.

**3.5 CLEANING**

- A. Clean adjacent surfaces of firestopping materials.

**3.6 PROTECTION**

- A. Protect adjacent surfaces from damage by material installation.

**END OF SECTION 07 84 00**



**SECTION 07 92 00**

**JOINT SEALANTS**

**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 SECTION INCLUDES**

- A. Nonsag gunnable joint sealants.
- B. Self-leveling pourable joint sealants.
- C. Joint backings and accessories.
- D. Owner-provided field quality control.

**1.3 RELATED REQUIREMENTS**

- A. Section 07 84 00 - Firestopping: Firestopping sealants.
- B. Section 08 71 00 - Door Hardware: Setting exterior door thresholds in sealant.
- C. Section 08 80 00 - Glazing: Glazing sealants and accessories.

**1.4 REFERENCE STANDARDS**

- A. ASTM C661 - Standard Test Method for Indentation Hardness of Elastomeric-Type Sealants by Means of a Durometer; 2015.
- B. ASTM C794 - Standard Test Method for Adhesion-In-Peel of Elastomeric Joint Sealants; 2018.
- C. ASTM C834 - Standard Specification for Latex Sealants; 2017.
- D. ASTM C919 - Standard Practice for Use of Sealants in Acoustical Applications; 2018.
- E. ASTM C920 - Standard Specification for Elastomeric Joint Sealants; 2018.
- F. ASTM C1087 - Standard Test Method for Determining Compatibility of Liquid-Applied Sealants with Accessories Used in Structural Glazing Systems; 2016.
- G. ASTM C1193 - Standard Guide for Use of Joint Sealants; 2016.
- H. ASTM C1248 - Standard Test Method for Staining of Porous Substrate by Joint Sealants; 2018.
- I. ASTM C1311 - Standard Specification for Solvent Release Sealants; 2014.
- J. ASTM C1330 - Standard Specification for Cylindrical Sealant Backing for Use with Cold Liquid-Applied Sealants; 2018.
- K. ASTM C1521 - Standard Practice for Evaluating Adhesion of Installed Weatherproofing Sealant Joints; 2019 (Reapproved 2020).
- L. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).

M. SWRI (VAL) - SWR Institute Validated Products Directory; Current Edition.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data for Sealants: Submit manufacturer's technical data sheets for each product to be used, that includes 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 the product should not be used on.
  - 5. Substrates for which use of primer is required.
  - 6. Substrates for which laboratory adhesion and/or compatibility testing is required.
  - 7. Installation instructions, including precautions, limitations, and recommended backing materials and tools.
  - 8. Sample product 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 Accessory Products: Submit manufacturer's technical data sheet for each 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. Preconstruction Laboratory Test Reports: Submit at least four weeks prior to start of installation.
- G. Installation Plan: Submit at least four weeks prior to start of installation.
- H. Preinstallation Field Adhesion Test Plan: Submit at least two weeks prior to start of installation.
- I. Field Quality Control Plan: Submit at least two weeks prior to start of installation.
- J. Preinstallation Field Adhesion Test Reports: Submit filled out Preinstallation Field Adhesion Test Reports log within 10 days after completion of tests; include bagged test samples and photographic records.
- K. Installation Log: Submit filled out log for each length or instance of sealant installed.
- L. Field Quality Control Log: Submit filled out log for each length or instance of sealant installed, within 10 days after completion of inspections/tests; include bagged test samples and photographic records, if any.

## 1.6 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. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.
- E. 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. Stain Testing: In accordance with ASTM C1248; required only for stone substrates.
  - 4. Allow sufficient time for testing to avoid delaying the work.
  - 5. Deliver to manufacturer sufficient samples for testing.
  - 6. Report manufacturer's recommended corrective measures, if any, including primers or techniques not indicated in product data submittals.
  - 7. Testing is not required if sealant manufacturer provides data showing previous testing, not older than 24 months, that shows satisfactory adhesion, lack of staining, and compatibility.
- F. Installation Plan: Include schedule of sealed joints, including the following.
  - 1. Joint depth indicated in Contract Documents; to face of backing material at centerline of joint.
  - 2. Method to be used to protect adjacent surfaces from sealant droppings and smears, with acknowledgement that some surfaces cannot be cleaned to like-new condition and therefore prevention is imperative.
  - 3. Approximate date of installation, for evaluation of thermal movement influence.
  - 4. Installation Log Form: Include the following data fields, with known information filled out.
    - a. Unique identification of each length or instance of sealant installed.
    - b. Location on project.
    - c. Substrates.
    - d. Sealant used.
    - e. Stated movement capability of sealant.
    - f. Primer to be used, or indicate as "No primer" used.
    - g. Size and actual backing material used.

- h. Date of installation.
  - i. Name of installer.
  - j. Actual joint width; provide space to indicate maximum and minimum width.
  - k. Actual joint depth to face of backing material at centerline of joint.
  - l. Air temperature.
- G. Preinstallation Field Adhesion Test Plan: Include destructive field adhesion testing of one sample of each combination of sealant type and substrate, except interior acrylic latex sealants, and include the following for each tested sample.
- 1. Identification of testing agency.
  - 2. Name(s) of sealant manufacturers' field representatives who will be observing
  - 3. Preinstallation Field Adhesion Test Log Form: Include the following data fields, with known information filled out.
    - a. Substrate; if more than one type of substrate is involved in a single joint, provide two entries on form, for testing each sealant substrate side separately.
    - b. Test date.
    - c. Location on project.
    - d. Sealant used.
    - e. Stated movement capability of sealant.
    - f. Test method used.
    - g. Date of installation of field sample to be tested.
    - h. Date of test.
    - i. Copy of test method documents.
    - j. Age of sealant upon date of testing.
    - k. Test results, modeled after the sample form in the test method document.
    - l. Indicate use of photographic record of test.
- H. Field Quality Control Plan:
- 1. Visual inspection of entire length of sealant joints.
  - 2. Destructive field adhesion testing of sealant joints, except interior acrylic latex sealant.
    - a. For each different sealant and substrate combination, allow for one test every 100 feet in the first 1000 linear feet, and one test per 1000 linear feet thereafter, or once per floor on each elevation.
    - b. If any failures occur in the first 1000 linear feet, continue testing at frequency of one test per 500 linear feet at no extra cost to Owner.

3. Field testing agency's qualifications.
  4. Field Quality Control Log Form: Show same data fields as on Preinstallation Field Adhesion Test Log, with known information filled out and lines for multiple tests per sealant/substrate combinations; include visual inspection and specified field testing; allow for possibility that more tests than minimum specified may be necessary.
- I. Field Adhesion Test Procedures:
1. Allow sealants to fully cure as recommended by manufacturer before testing.
  2. Have a copy of the test method document available during tests.
  3. Take photographs or make video records of each test, with joint identification provided in the photos/videos; for example, provide small erasable whiteboard positioned next to joint.
  4. Record the type of failure that occurred, other information required by test method, and the information required on the Field Quality Control Log.
  5. When performing destructive tests, also inspect the opened joint for proper installation characteristics recommended by manufacturer, and report any deficiencies.
  6. Deliver the samples removed during destructive tests in separate sealed plastic bags, identified with project, location, test date, and test results, to Owner.
  7. If any combination of sealant type and substrate does not show evidence of minimum adhesion or shows cohesion failure before minimum adhesion, report results to Architect.
- J. Destructive Field Adhesion Test: Test for adhesion in accordance with ASTM C1521, using Destructive Tail Procedure.
1. Sample: At least 18 inches long.
  2. Minimum Elongation Without Adhesive Failure: Consider the tail at rest, not under any elongation stress; multiply the stated movement capability of the sealant in percent by two; then multiply 1 inch by that percentage; if adhesion failure occurs before the "1 inch mark" is that distance from the substrate, the test has failed.
  3. If either adhesive or cohesive failure occurs prior to minimum elongation, take necessary measures to correct conditions and re-test; record each modification to products or installation procedures.
  4. Record results on Field Quality Control Log.
  5. Repair failed portions of joints.
- K. Field Adhesion Tests of Joints: Test for adhesion using most appropriate method in accordance with ASTM C1521, or other applicable method as recommended by manufacturer.

## **1.7 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Correct defective work within a five year period after Date of Substantial Completion.
- C. Warranty: Include coverage for installed sealants and accessories that fail to achieve watertight seal, exhibit loss of adhesion or cohesion, or do not cure.

## **PART 2 PRODUCTS**

### **2.1 JOINT SEALANT APPLICATIONS**

**A. Scope:**

1. Exterior Joints: Seal open joints, whether or not the joint is indicated on drawings, unless specifically indicated not to be sealed. Exterior joints to be sealed include, but are not limited to, the following items.
  - a. Wall expansion and control joints.
  - b. Joints between door, window, and other frames and adjacent construction.
  - c. Joints between different exposed materials.
  - d. Openings below ledge angles in masonry.
  - e. Other joints indicated below.
2. 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. Other joints indicated below.
3. Do not seal the following types of joints.
  - a. Intentional weepholes in masonry.
  - b. Joints indicated to be treated with manufactured expansion joint cover or some other type of sealing device.
  - c. Joints where sealant is specified to be provided by manufacturer of product to be sealed.
  - d. Joints where installation of sealant is specified in another section.
  - e. Joints between suspended panel ceilings/grid and walls.

**B. Exterior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.**

1. Lap Joints in Sheet Metal Fabrications: Butyl rubber, non-curing.
2. Lap Joints between Manufactured Metal Panels: Butyl rubber, non-curing.
3. Control and Expansion Joints in Concrete Paving: Self-leveling polyurethane "traffic-grade" sealant.
4. Wiring Slots in Concrete Paving: Self-leveling epoxy sealant.

**C. Interior Joints: Use non-sag polyurethane sealant, unless otherwise indicated.**

1. Wall and Ceiling Joints in Non-Wet Areas: Acrylic emulsion latex sealant.
2. Wall and Ceiling Joints in Wet Areas: Non-sag polyurethane sealant for continuous liquid immersion.
3. Floor Joints in Wet Areas: Non-sag polyurethane "non-traffic-grade" sealant suitable for continuous liquid immersion.

4. Joints between Fixtures in Wet Areas and Floors, Walls, and Ceilings: Mildew-resistant silicone sealant; white.
  5. In Sound-Rated Assemblies: Acrylic emulsion latex sealant.
  6. Narrow Control Joints in Interior Concrete Slabs: Self-leveling epoxy sealant.
  7. Other Floor Joints: Self-leveling polyurethane "traffic-grade" sealant.
- D. Interior Wet Areas: Bathrooms, restrooms, and kitchens; fixtures in wet areas include plumbing fixtures, countertops, cabinets, and other similar items.
- E. Sound-Rated Assemblies: Walls and ceilings identified as "STC-rated", "sound-rated", or "acoustical".

## **2.2 JOINT SEALANTS - GENERAL**

- A. Sealants and Primers: Provide products having lower volatile organic compound (VOC) content than indicated in SCAQMD 1168.
- B. Colors: As indicated on drawings.

## **2.3 NONSAG JOINT SEALANTS**

- A. Type 6 - Mildew-Resistant Silicone Sealant: ASTM C920, Grade NS, Uses M and A; single component, mildew resistant; not expected to withstand continuous water immersion or traffic.
1. Color: Clear.
  2. Manufacturers:
    - a. Sika Corporation; Sikasil GP: [www.usa-sika.com](http://www.usa-sika.com).
    - b. 786 Silicone Sealant - M, Dow Corning. .
    - c. SCS1700 Sanitary, GE Silicones.
- B. Type 5 - Hybrid Urethane Sealant: ASTM C920, Grade NS, Uses M and A; single component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 35 percent, minimum.
  2. Hardness Range: 20 to 40, Shore A, when tested in accordance with ASTM C661.
  3. Color: Match adjacent finished surfaces.
  4. Service Temperature Range: Minus 40 to 180 degrees F.
  5. Manufacturers:
    - a. Franklin International Inc; Titebond WeatherMaster ULTIMATE MP Sealant: [www.titebond.com](http://www.titebond.com).
    - b. Sherwin-Williams Company; Stampede 100 Low-Modulus Hybrid Urethane Sealant: [www.sherwin-williams.com](http://www.sherwin-williams.com).
    - c. Tremco Commercial Sealants and Waterproofing; Dymonic FC: [www.tremcosealants.com](http://www.tremcosealants.com).
    - d. Substitutions: See Section 01 60 00 - Product Requirements.

- C. Type 1 - Polyurethane Sealant: ASTM C920, Grade NS, Uses M and A; single or multi-component; not expected to withstand continuous water immersion or traffic.
1. Movement Capability: Plus and minus 25 percentPlus and minus \_\_\_\_ percent, minimum.
  2. Color: Match adjacent finished surfaces.
  3. Service Temperature Range: Minus 40 to 180 degrees F.
  4. Manufacturers:
    - a. Tremco Commercial Sealants & Waterproofing; Dymeric 240 FC: [www.tremcosealants.com](http://www.tremcosealants.com).
    - b. BASF. MasterSeal NP2. [www.basf.com](http://www.basf.com).
    - c. Substitutions: See Section 01 60 00 - Product Requirements.
- D. Type 7 - Acrylic Emulsion Latex: Water-based; ASTM C834, single component, non-staining, non-bleeding, non-sagging; not intended for exterior use.
1. Color: Standard colors matching finished surfaces, Type OP (opaque).
  2. Grade: ASTM C834; Grade - NF.
  3. Manufacturers:
    - a. BASF; Sonolac. [www.basf.com](http://www.basf.com).
    - b. Pecora Corporation; AC-20+: [www.pecora.com](http://www.pecora.com).
    - c. Tremco Commercial Sealants & Waterproofing; Tremflex 834: [www.tremcosealants.com](http://www.tremcosealants.com).
    - d. Substitutions: Not permitted.
- E. Non-Curing Butyl Sealant: Solvent-based; ASTM C1311; single component, non-sag, non-skinning, non-hardening, non-bleeding; vapor-impermeable; intended for fully concealed applications.
1. Manufacturers:
    - a. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.4 SELF-LEVELING SEALANTS

- A. Type 3 - Self-Leveling Polyurethane Sealant for Continuous Water Immersion: Polyurethane; ASTM C920, Grade P, Uses M and A; single or multi-component; explicitly approved by manufacturer for traffic exposure and continuous water immersion.
1. Movement Capability: Plus and minus 25 percent, minimum.
  2. Hardness Range: 35 to 55, Shore A, when tested in accordance with ASTM C661.
  3. Color: Gray.
  4. Service Temperature Range: Minus 40 to 180 degrees F.
  5. Manufacturers:
    - a. Sika Corporation; Sikaflex-1c SL: [www.usa-sika.com](http://www.usa-sika.com).



- b. W. R. MEADOWS, Inc; POURTHANE SL: [www.wrmeadows.com](http://www.wrmeadows.com).
- c. MasterSeal SL 1; BASF the Chemical Company .
- d. Vulkem 45; Tremco

## **2.5 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.
  - 1. Type for Joints Not Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type O - Open Cell Polyurethane.
  - 2. Type for Joints Subject to Pedestrian or Vehicular Traffic: ASTM C1330; Type B - Bi-Cellular Polyethylene.
  - 3. Open Cell: 40 to 50 percent larger in diameter than joint width.
  - 4. Closed Cell and Bi-Cellular: 25 to 33 percent larger in diameter than joint width.
  - 5. Manufacturers:
    - a. Nomaco, Inc; HBR: [www.nomaco.com](http://www.nomaco.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Backing Tape: Self-adhesive polyethylene tape with surface that sealant will not adhere to and recommended by tape and sealant manufacturers for specific application.
- C. Masking Tape: Self-adhesive, nonabsorbent, non-staining, removable without adhesive residue, and compatible with surfaces adjacent to joints and sealants.
- D. Joint Cleaner: Non-corrosive and non-staining type, type recommended by sealant manufacturer; compatible with joint forming materials.

## **PART 3 EXECUTION**

### **3.1 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.
- D. Preinstallation Adhesion Testing: Install a sample for each test location indicated in the test plan.
  - 1. Test each sample as specified in PART 1 under QUALITY ASSURANCE article.
  - 2. Notify Architect of date and time that tests will be performed, at least seven days in advance.
  - 3. Arrange for sealant manufacturer's technical representative to be present during tests.
  - 4. Record each test on Preinstallation Adhesion Test Log as indicated.

5. If any sample fails, review products and installation procedures, consult manufacturer, or take whatever other measures are necessary to ensure adhesion; re-test in a different location; if unable to obtain satisfactory adhesion, report to Architect.
6. After completion of tests, remove remaining sample material and prepare joint for new sealant installation.

### **3.2 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.
- E. Concrete Floor Joints That Will Be Exposed in Completed Work: Test joint filler in inconspicuous area to verify that it does not stain or discolor slab.

### **3.3 INSTALLATION**

- A. Perform work in accordance with sealant manufacturer's requirements for preparation of surfaces and material installation instructions.
- B. Perform installation in accordance with ASTM C1193.
- C. Perform acoustical sealant application work in accordance with ASTM C919.
- D. Measure joint dimensions and size joint backers to achieve the following, unless otherwise indicated:
  1. Width/depth ratio of 2:1.
  2. Neck dimension no greater than 1/3 of the joint width.
  3. Surface bond area on each side not less than 75 percent of joint width.
- E. Install bond breaker backing tape where backer rod cannot be used.
- F. Install sealant free of air pockets, foreign embedded matter, ridges, and sags, and without getting sealant on adjacent surfaces.
- G. 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.
- H. Nonsag Sealants: Tool surface concave, unless otherwise indicated; remove masking tape immediately after tooling sealant surface.

### **3.4 FIELD QUALITY CONTROL**

- A. Perform field quality control inspection/testing as specified in PART 1 under QUALITY ASSURANCE article.
- B. Destructive Adhesion Testing: If there are any failures in first 1000 linear feet, notify Architect immediately.
- C. Remove and replace failed portions of sealants using same materials and procedures as indicated for original installation.

- D. Repair destructive test location damage immediately after evaluation and recording of results.

**END OF SECTION 07 92 00**

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**SECTION 08 11 13**

**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 SECTION INCLUDES**

- A. Non-fire-rated hollow metal doors and frames.
- B. Hollow metal frames for wood doors.
- C. Hollow metal borrowed lites glazing frames.
- D. Accessories, including glazing, louvers, and matching panels.

**1.3 RELATED REQUIREMENTS**

- A. Section 08 71 00 - Door Hardware.
- B. Section 08 80 00 - Glazing: Glass for doors and borrowed lites.
- C. Section 09 91 13 - Exterior Painting: Field painting.
- D. Section 09 91 23 - Interior Painting: Field painting.

**1.4 ABBREVIATIONS AND ACRONYMS**

- A. ANSI: American National Standards Institute.
- B. ASCE: American Society of Civil Engineers.
- C. HMMA: Hollow Metal Manufacturers Association.
- D. NAAMM: National Association of Architectural Metal Manufacturers.
- E. NFPA: National Fire Protection Association.
- F. SDI: Steel Door Institute.
- G. UL: Underwriters Laboratories.

**1.5 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ANSI/SDI A250.4 - Test Procedure and Acceptance Criteria for Physical Endurance for Steel Doors, Frames and Frame Anchors; 2011.
- C. ANSI/SDI A250.6 - Recommended Practice for Hardware Reinforcing on Standard Steel Doors and Frames; 2003 (R2009).
- D. ANSI/SDI A250.8 - Specifications for Standard Steel Doors and Frames (SDI-100); 2017.

- E. ANSI/SDI A250.10 - Test Procedure and Acceptance Criteria for Prime Painted Steel Surfaces for Steel Doors and Frames; 2011.
- F. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- G. ASTM A1008/A1008M - Standard Specification for Steel, Sheet, Cold-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, Required Hardness, Solution Hardened, and Bake Hardenable; 2020.
- H. ASTM A1011/A1011M - Standard Specification for Steel, Sheet and Strip, Hot-Rolled, Carbon, Structural, High-Strength Low-Alloy, High-Strength Low-Alloy with Improved Formability, and Ultra-High Strength; 2018a.
- I. ASTM C143/C143M - Standard Test Method for Slump of Hydraulic-Cement Concrete; 2020.
- J. ASTM C476 - Standard Specification for Grout for Masonry; 2020.
- K. BHMA A156.115 - American National Standard for Hardware Preparation in Steel Doors and Steel Frames; 2016.
- L. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.
- M. NAAMM HMMA 830 - Hardware Selection for Hollow Metal Doors and Frames; 2002.
- N. NAAMM HMMA 831 - Hardware Locations for Hollow Metal Doors and Frames; 2011.
- O. NAAMM HMMA 840 - Guide Specifications For Receipt, Storage and Installation of Hollow Metal Doors and Frames; 2007.
- P. NAAMM HMMA 861 - Guide Specifications for Commercial Hollow Metal Doors and Frames; 2014.
- Q. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- R. SDI 117 - Manufacturing Tolerances for Standard Steel Doors and Frames; 2013.

## **1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Materials and details of design and construction, hardware locations, reinforcement type and locations, anchorage and fastening methods, and finishes; and one copy of referenced standards/guidelines.
- C. Samples: Submit two samples of metal, 2 by 2 inches in size, showing factory finishes, colors, and surface texture.
- D. Installation Instructions: Manufacturer's published instructions, including any special installation instructions relating to this project.
- E. Manufacturer's Certificate: Certification that products meet or exceed specified requirements.
- F. Installer's Qualification Statement.

## **1.7 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Provide hollow metal doors and frames from SDI Certified manufacturer: [www.steeldoor.org/sdicertified.php](http://www.steeldoor.org/sdicertified.php).

- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years of documented experience.
- C. Maintain at project site copies of reference standards relating to installation of products specified.

## **1.8 DELIVERY, STORAGE, AND HANDLING**

- A. Comply with NAAMM HMMA 840 or ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
- B. Protect with resilient packaging; avoid humidity build-up under coverings; prevent corrosion and adverse effects on factory applied painted finish.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Hollow Metal Doors and Frames:
  - 1. Ceco Door, an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 2. Curries, an Assa Abloy Group company: [www.assaabloydss.com](http://www.assaabloydss.com).
  - 3. Mesker, dormakaba Group: [www.meskeropeningsgroup.com](http://www.meskeropeningsgroup.com).
  - 4. Republic Doors, an Allegion brand: [www.republicdoor.com](http://www.republicdoor.com).
  - 5. Steelcraft, an Allegion brand: [www.allegion.com](http://www.allegion.com).
- B. Sound-Rated Hollow Metal Doors and Frames:
  - 1. Megamet Industries, Inc; MegaSonic 3A - Series Flush Doors: [www.megametusa.com](http://www.megametusa.com).
  - 2. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.2 PERFORMANCE REQUIREMENTS**

- A. Requirements for Hollow Metal Doors and Frames:
  - 1. Steel Sheet: Comply with one or more of the following requirements; galvanized steel complying with ASTM A653/A653M, cold-rolled steel complying with ASTM A1008/A1008M, or hot-rolled pickled and oiled (HRPO) steel complying with ASTM A1011/A1011M, commercial steel (CS) Type B, for each.
  - 2. Accessibility: Comply with ICC A117.1 and ADA Standards.
  - 3. Exterior Door Top Closures: Flush end closure channel, with top and door faces aligned.
  - 4. Door Edge Profile: Hinged edge square, and lock edge beveled.
  - 5. Typical Door Face Sheets: Flush.
  - 6. Glazed Lights: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings. Style: Manufacturers standard.
  - 7. Hardware Preparations, Selections and Locations: Comply with NAAMM HMMA 830 and NAAMM HMMA 831 or BHMA A156.115 and ANSI/SDI A250.8 (SDI-100) in accordance with specified requirements.
  - 8. Zinc Coating for Typical Interior and/or Exterior Locations: Provide metal components zinc-coated (galvanized) and/or zinc-iron alloy-coated (galvanized) by the hot-dip process in accordance with ASTM

A653/A653M, with manufacturer's standard coating thickness, unless noted otherwise for specific hollow metal doors and frames.

- a. Based on SDI Standards: Provide at least A40/ZF120 (galvannealed) when necessary, coating not required for typical interior door applications, and at least A60/ZF180 (galvannealed) for corrosive locations.
- B. Combined Requirements: If a particular door and frame unit is indicated to comply with more than one type of requirement, comply with the specified requirements for each type; for instance, an exterior door that is also indicated as being sound-rated must comply with the requirements specified for exterior doors and for sound-rated doors; where two requirements conflict, comply with the most stringent.

## **2.3 HOLLOW METAL DOORS**

- A. Door Finish: Factory primed and field finished.
- B. Interior Doors, Non-Fire Rated:
  - 1. Based on SDI Standards: ANSI/SDI A250.8 (SDI-100).
    - a. Level 2 - Heavy-duty.
    - b. Physical Performance Level B, 500,000 cycles; in accordance with ANSI/SDI A250.4.
    - c. Model 2 - Seamless.
    - d. Door Face Metal Thickness: 18 gage, 0.042 inch, minimum.
    - e. Zinc Coating: A60/ZF180 galvannealed coating; ASTM A653/A653M.
  - 2. Door Core Material: Vertical steel stiffeners.
  - 3. Door Thickness: 1-3/4 inches, nominal.

## **2.4 HOLLOW METAL FRAMES**

- A. Comply with standards and/or custom guidelines as indicated for corresponding door in accordance with applicable door frame requirements.
- B. Frame Finish: Factory primed and field finished.
- C. Interior Door Frames, Non-Fire Rated: Slip-on type at gypsum board walls, and knock-down type at masonry walls.
  - 1. Terminated Stops: Provide at interior doors; closed end stop terminated 6 inch, maximum, above floor at 45 degree angle.
  - 2. Frame Metal Thickness: 18 gauge, 0.042 inch, minimum.
- D. Frames for Wood Doors: Comply with frame requirements in accordance with corresponding door.
- E. Mullions for Pairs of Doors: Removable type, with profile similar to jams.
- F. Borrowed Lites Glazing Frames: Construction and face dimensions to match door frames, and as indicated on drawings.
- G. Transom Bars: Fixed, of profile same as jamb and head.
- H. Provide mortar guard boxes for hardware cut-outs in frames to be installed in masonry or to be grouted.



- I. Frames in Masonry Walls: Size to suit masonry coursing with head member 4 inches high to fill opening without cutting masonry units.
- J. Frames Wider than 48 inches: Reinforce with steel channel fitted tightly into frame head, flush with top.

## **2.5 FINISHES**

- A. Primer: Rust-inhibiting, complying with ANSI/SDI A250.10, zinc molybdate type.

## **2.6 ACCESSORIES**

- A. Glazing: As specified in Section 08 80 00, factory installed.
- B. Removable Stops: Formed sheet steel, shape as indicated on drawings, mitered or butted corners; prepared for countersink style tamper proof screws.
- C. Astragals for Double Doors: Specified in Section 08 71 00.
- D. Mechanical Fasteners for Concealed Metal-to-Metal Connections: Self-drilling, self-tapping, steel with electroplated zinc finish.
  - 1. Manufacturers:
    - a. ITW Commercial Construction North America; ITW CCNA-Buildex Teks Select Series: [www.ITWBuildex.com](http://www.ITWBuildex.com).
- E. Grout for Frames: Mortar grout complying with ASTM C476 with maximum slump of 4 inches as measured in accordance with ASTM C143/C143M for hand troweling in place; plaster grout and thinner pumpable grout are prohibited.
- F. Silencers: Resilient rubber, fitted into drilled hole; provide three on strike side of single door, three on center mullion of pairs, and two on head of pairs without center mullions.
- G. Temporary Frame Spreaders: Provide for factory- or shop-assembled frames.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Verify that finished walls are in plane to ensure proper door alignment.

### **3.2 PREPARATION**

- A. Coat inside of frames to be installed in masonry or to be grouted, with bituminous coating, prior to installation.

### **3.3 INSTALLATION**

- A. Install doors and frames in accordance with manufacturer's instructions and related requirements of specified door and frame standards or custom guidelines indicated.
- B. Install prefinished frames after painting and wall finishes are complete.
- C. Install fire rated units in accordance with NFPA 80.

- D. Coordinate frame anchor placement with wall construction.
- E. Grout frames in masonry construction, using hand trowel methods; brace frames so that pressure of grout before setting will not deform frames.
- F. Install door hardware as specified in Section 08 71 00.
  - 1. Comply with recommended practice for hardware placement of doors and frames in accordance with ANSI/SDI A250.6 or NAAMM HMMA 861.
- G. Coordinate installation of electrical connections to electrical hardware items.

### **3.4 TOLERANCES**

- A. Clearances Between Door and Frame: Comply with related requirements of specified frame standards or custom guidelines indicated in accordance with SDI 117 or NAAMM HMMA 861.
- B. Maximum Diagonal Distortion: 1/16 inch measured with straight edge, corner to corner.

### **3.5 ADJUSTING**

- A. Adjust for smooth and balanced door movement.
- B. Test sound control doors for force to close, latch, and unlatch; adjust as necessary in compliance with requirements.

### **3.6 SCHEDULE**

- A. Refer to Door and Frame Schedule on the drawings.

**END OF SECTION 08 11 13**

**SECTION 08 14 16**

**FLUSH WOOD DOORS**

**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 SECTION INCLUDES**

- A. Flush wood doors; flush and flush glazed configuration; fire-rated, non-rated, and acoustical.

**1.3 RELATED REQUIREMENTS**

- A. Section 08 11 13 - Hollow Metal Doors and Frames.
- B. Section 08 71 00 - Door Hardware.
- C. Section 08 80 00 - Glazing.

**1.4 REFERENCE STANDARDS**

- A. ANSI A208.1 - American National Standard for Particleboard; 2016.
- B. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- C. AWI (QCP) - Quality Certification Program; Current Edition.
- D. AWI/AWMAC/WI (AWS) - Architectural Woodwork Standards; 2014, with Errata (2018).
- E. AWMAC/WI (NAAWS) - North American Architectural Woodwork Standards, U.S. Version 3.1; 2017, with Errata (2019).
- F. NEMA LD 3 - High-Pressure Decorative Laminates; 2005.
- G. NFPA 80 - Standard for Fire Doors and Other Opening Protectives; 2019.
- H. WDMA I.S. 1A - Interior Architectural Wood Flush Doors; 2013.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Indicate door core materials and construction; veneer species, type and characteristics.
- C. Shop Drawings: Show doors and frames, elevations, sizes, types, swings, undercuts, beveling, blocking for hardware, factory machining, factory finishing, cutouts for glazing and other details.
  - 1. Provide information as required by AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS).
- D. Certificate: Submit labels and certificates required by quality assurance and quality control programs.
- E. Manufacturer's Installation Instructions: Indicate special installation instructions.
- F. Installer's Qualification Statement.

- G. Warranty, executed in Owner's name.

## **1.6 QUALITY ASSURANCE**

- A. Maintain one copy of the specified door quality standard on site for review during installation and finishing.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section, with not less than three years of documented experience.
1. Company with at least one project within past five years with value of woodwork within at least 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.
- C. Installer Qualifications: Company specializing in performing work of the type specified in this section, with not less than three years of documented experience.
- D. 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](http://www.awiqcp.org).
  2. Provide labels or certificates indicating that installed work will comply with AWI/AWMAC/WI (AWS) or AWMAC/WI (NAAWS) requirements for grade or grades specified.
  3. Provide designated labels on shop drawings as required by certification program.
  4. Provide designated labels on installed products as required by certification program.
  5. Submit certifications upon completion of installation that verifies this work is in compliance with specified requirements.

## **1.7 DELIVERY, STORAGE, AND HANDLING**

- A. Package, deliver and store doors in accordance with specified quality standard.
- B. Accept doors on site in manufacturer's packaging, and inspect for damage.
- C. Protect doors with resilient packaging sealed with heat shrunk plastic; do not store in damp or wet areas or areas where sunlight might bleach veneer; seal top and bottom edges with tinted sealer if stored more than one week, and break seal on site to permit ventilation.

## **1.8 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Interior Doors: Provide manufacturer's warranty for the life of the installation.
- C. Include coverage for delamination of veneer, warping beyond specified installation tolerances, defective materials, and telegraphing core construction.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. High Pressure Decorative Laminate (HPDL) Faced Doors:

1. Ampco Products, Inc: [www.ampco.com](http://www.ampco.com).
2. Oregon Door: [www.oregondoor.com](http://www.oregondoor.com).
3. Poncraft Door Co: [www.poncraft.com](http://www.poncraft.com).
4. VT Industries, Inc: [www.vtindustries.com](http://www.vtindustries.com).
5. Eggers Industries: [www.eggersindustries.com](http://www.eggersindustries.com).
6. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.2 DOORS AND PANELS**

- A. Doors: See drawings for locations and additional requirements.
  1. Quality Standard: Custom Grade, Heavy Duty performance, in accordance with AWI/AWMAC/WI (AWS), AWMAC/WI (NAAWS) or WDMA I.S. 1A.
  2. High Pressure Decorative Laminate (HPDL) Faced Doors: 5-ply unless otherwise indicated.
- B. Interior Doors: 1-3/4 inches thick unless otherwise indicated; flush construction.
  1. Provide solid core doors at each location.
  2. High pressure decorative laminate (HPDL) finish as indicated on drawings.

## **2.3 DOOR AND PANEL CORES**

- A. Non-Rated Solid Core and 20 Minute Rated Doors: Type particleboard core (PC), plies and faces as indicated.
- B. Core for Low Pressure Decorative Laminate (LPDL), Non-Rated and 20 Minute Rated Doors: ANSI A208.1 Grade M-2 particleboard, minimum, with no seams on faces; edges reinforced as required to pass performance grade specified.

## **2.4 DOOR FACINGS**

- A. High Pressure Decorative Laminate (HPDL) Facing for Non-Fire-Rated Doors: NEMA LD 3, HGS; color(s) as indicated; finish as selected.
- B. Facing Adhesive: Type I - waterproof.

## **2.5 DOOR CONSTRUCTION**

- A. Fabricate doors in accordance with door quality standard specified.
- B. Cores Constructed with stiles and rails:
  1. Provide solid blocks at lock edge and top of door for closer for hardware reinforcement.
  2. Provide solid blocking for other throughbolted hardware.
- C. Where supplementary protective edge trim is required, install trim after veneer facing has been applied full-width.
- D. Glazed Openings: Non-removable stops on non-secure side; sizes and configurations as indicated on drawings.
- E. Factory machine doors for hardware other than surface-mounted hardware, in accordance with hardware requirements and dimensions.

- F. Factory fit doors for frame opening dimensions identified on shop drawings, with edge clearances in accordance with specified quality standard.
- G. Provide edge clearances in accordance with the quality standard specified.

## **2.6 ACCESSORIES**

- A. Hollow Metal Door Frames: See Section 08 11 13.
- B. Aluminum Door Frames: As specified in Section 08 12 16.
- C. Glazed Openings:
  - 1. Heat-Strengthened and Fully Tempered Glass: ASTM C1048.
  - 2. Glazing: Single vision units, 1/4 inch thick glass.
  - 3. Tint: Clear.
- D. Door Hardware: See Section 08 71 00.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that opening sizes and tolerances are acceptable.
- C. Do not install doors in frame openings that are not plumb or are out-of-tolerance for size or alignment.

### **3.2 INSTALLATION**

- A. Install doors in accordance with manufacturer's instructions and specified quality standard.
  - 1. Install fire-rated doors in accordance with NFPA 80 requirements.
- B. Factory-Finished Doors: Do not field cut or trim; if fit or clearance is not correct, replace door.
- C. Use machine tools to cut or drill for hardware.
- D. Coordinate installation of doors with installation of frames and hardware.
- E. Install door louvers plumb and level.

### **3.3 TOLERANCES**

- A. Comply with specified quality standard for fit and clearance tolerances.
- B. Comply with specified quality standard for telegraphing, warp, and squareness.

### **3.4 ADJUSTING**

- A. Adjust doors for smooth and balanced door movement.
- B. Adjust closers for full closure.

**3.5 SCHEDULE - SEE DRAWINGS**

**END OF SECTION 08 14 16**

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**SECTION 08 31 00**

**ACCESS DOORS AND PANELS**

**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 SECTION INCLUDES**

- A. Wall and ceiling mounted access units.

**1.3 RELATED REQUIREMENTS**

- A. Section 09 91 23 - Interior Painting: Field paint finish.
- B. Division 23 or Section 23 33 00 - Air Duct Accessories: Access doors in ductwork.

**1.4 REFERENCE STANDARDS**

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

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide sizes, types, finishes, hardware, scheduled locations, and details of adjoining work.
- C. Shop Drawings: Indicate exact position of each access door and/or panel unit.
- D. Samples: Submit two access units, 12x12 inch in size illustrating frame configuration and anchors.
- E. Manufacturer's Installation Instructions: Indicate installation requirements and rough-in dimensions.
- F. Project Record Documents: Record actual locations of each access unit.

**1.6 QUALITY ASSURANCE**

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified and with at least three years documented experience.

**PART 2 PRODUCTS**

**2.1 WALL AND CEILING MOUNTED ACCESS UNITS**

- A. Manufacturers:
  - 1. Activar Construction Products Group - JL Industries: [www.activarcpg.com](http://www.activarcpg.com).
  - 2. ACUDOR Products Inc: [www.acudor.com](http://www.acudor.com).
    - a. Wall and Ceiling Mounted Units: ACUDOR DW-5058.

3. Babcock-Davis: [www.babcockdavis.com](http://www.babcockdavis.com).
  4. Cendrex, Inc: [www.cendrex.com](http://www.cendrex.com).
    - a. Wall-Mounted Units: Cendrex AHD, flush door, face frame, hinged.
    - b. Recess-Mounted Units for Wall Finish: Cendrex AHA-GYP, with drywall bead flange.
  5. Karp Associates, Inc: [www.karpinc.com](http://www.karpinc.com).
  6. Milcor, Inc: [www.milcorinc.com](http://www.milcorinc.com). **Basis of Design.**
    - a. Model M3202: Painted steel 14 gage frame and door.
    - b. Model MS3202: Stainless steel 16 gage frame and door.
    - c. Models DW3203 and K3200: Painted steel 16 gage frame; 14 gage door.
    - d. Model ATR3204: Painted steel 16 gage frame; 18 gage door.
    - e. Fire-Rated Model 3218: Painted and stainless steel 14 gauge frame; 20 gage door.
  7. Nystrom, Inc: [www.nystrom.com](http://www.nystrom.com).
- B. Wall and Ceiling Mounted Units: Factory fabricated door and frame, fully assembled units with corner joints welded, filled and ground flush; square and without rack or warp; coordinate requirements with type of installation assembly being used for each unit.
1. Style: As indicated on drawings.
  2. Door Style: Double-skinned hollow panel.
  3. Heavy Duty Frames: 14 gauge, 0.0747 inch, minimum thickness.
  4. Double-Skinned Hollow Steel Sheet Door Panels: 16 gauge, 0.059 inch, minimum thickness, on both sides and along each edge.
  5. Door/Panel Size: As indicated on the drawings.
  6. Hardware:
    - a. Hardware for Fire-Rated Units: As required for listing.
    - b. Hinges for Non-Fire-Rated Units: Continuous piano hinge.
    - c. Latch/Lock: Screw driver slot for quarter turn cam latch.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that rough openings are correctly sized and located.
- B. Begin installation only after substrates have been properly prepared, and if the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

### **3.2 PREPARATION**

- A. Clean surfaces thoroughly prior to proceeding with this work.
- B. Prepare surfaces using methods recommended by manufacturer for applicable substrates in accordance with project conditions.

### **3.3 INSTALLATION**

- A. Install units in accordance with manufacturer's instructions.
- B. Install frames plumb and level in openings, and secure units rigidly in place.
- C. Position units to provide convenient access to concealed equipment when necessary.

**END OF SECTION 08 31 00**

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SECTION 08 41 13

ALUMINUM-FRAMED ENTRANCES AND STOREFRONTS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Exterior aluminum entrance and storefront systems.
  - 2. Aluminum doors.
  - 3. Opaque insulated panels.
- B. Related Sections:
  - 1. Section 01 88 13 - Special Construction Performance Requirements.
  - 2. Section 07 92 00 - Joint Sealants: caulking of perimeter joints.
  - 3. Section 08 11 16 - Interior Aluminum Framing System.
  - 4. Section 08 42 26 - All-Glass Entrances.
  - 5. Section 08 44 13 - Glazed Aluminum Curtain Walls
  - 6. Section 08 71 00 - Door Hardware; hardware for aluminum doors.
  - 7. Section 08 80 00 - Glazing.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Shop Drawings: Include drawings showing elevations of each entrance and storefront type, detail sections of typical composite members, and glazing details.
- C. TDI Certification: Submit product data, shop drawings, and engineering calculations as required to demonstrate compliance with TDI windstorm requirements.
- D. Samples: Submit for approval duplicate samples showing the limits of color range to which the entrance, storefront, and door materials will be processed. Samples shall be representative of the materials to be furnished, and the color of the installed materials shall be within the range of the approved samples.
- E. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

1.3 SYSTEM DESCRIPTION AND PERFORMANCE

- A. Architectural Requirements
  - 1. Drawings are diagrammatic and do not purport to identify or solve problems of thermal or structural movement, glazing or anchorage.
  - 2. Requirements shown by details are intended to establish basic dimensions of units, sightlines and profiles of members.
  - 3. Provide concealed fastening wherever possible.
  - 4. Provide continuous snap-in thermally-broken aluminum backer plate at head and jamb conditions.
- B. Structural Requirements
  - 1. System to provide for expansion and contraction within system components caused by a cycling temperature range of 170°F. without causing detrimental effects to system or components.
  - 2. Design and size members to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ANSI/ASTM E 330.
  - 3. Limit mullion deflection to L/175, or flexure limit of glass with full recovery of glazing materials, whichever is less.
  - 4. System to accommodate, without damage to system or components, or deterioration of perimeter seal: Movement within system; movement between system and perimeter framing components; dynamic loading and release of loads; and deflection of structural support framing.
  - 5. Storefront manufacturer shall be responsible for design and engineering of storefront system, including necessary modifications to meet specified requirements and maintaining visual design concepts.

6. Attachment considerations shall take into account site peculiarities and expansion and contraction movements so there is no possibility of loosening, weakening or fracturing connection between units and building structure or between units themselves.
  7. Design anchors, fasteners, and braces to be structurally stressed not more than 50% of allowable stress when maximum loads are applied.
  8. Engineer storefront and entrances to be free from rattles, wind whistles and noise due to thermal and structural movement and wind pressure.
- C. Windborne-Debris Impact Resistance: Pass ASTM E1886 missile-impact and cyclic-pressure tests in accordance with ASTM E1996 for Wind Zone 4 for basic protection.
1. Large-Missile Test: For glazing located within 30 feet of grade.
  2. Small-Missile Test: For glazing located between 30 feet and 60 feet above grade
- D. Environmental Requirements
1. Drain water entering joints, condensation occurring in glazing channels, or migrating moisture occurring within system, to exterior. No leakage shall occur in wall when tested in accordance with ASTM E 331 at test pressure of 6.24 lbs/sq ft.
  2. Limit air infiltration through assembly to 0.06 cu ft/min/sq ft of assembly surface area, measured at a reference differential pressure across assembly of 1.57 lbs/sq ft. as measured in accordance with ANSI/ASTM E 283.
  3. Maintain continuous air and vapor barrier throughout assembly, primarily in line with inside pane of glass and heel bead of glazing compound.

#### 1.4 QUALITY ASSURANCE

- A. Single Source Responsibility: All exterior storefront, curtain wall, and aluminum framed entrances shall be the product of a single manufacturer and the work shall be performed by a single installer.
- B. Installer Qualifications: Engage an experienced installer who has successfully completed installation of glazed curtain wall systems similar in material, design, and extent to that indicated for the project and who is acceptable to the curtain wall manufacturer.
- C. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual."
- D. Single-Source Responsibility: Provide glazed aluminum curtain wall system and aluminum-framed entrances and storefronts for the project from one source from a single manufacturer.
- E. Field-Constructed Mock-Up: Before installing the curtain wall system, erect a sample curtain wall panel mock-up not less than 4' x 8', including mullions, panels, vision glass, and other elements of the system. Construct the mock-up on site in the location as directed by the Architect. Obtain the Architect's acceptance of the mock-up before starting final erection of the glazed aluminum curtain wall system. Maintain the mock-up in undisturbed condition during construction as a standard for judging completed curtain wall installation.
- F. Design Criteria: The drawings indicate sizes, profiles, and dimensional requirements of the curtain wall system. Curtain wall systems having equal performance characteristics with deviations from indicated dimensions and profiles may be considered, provided deviations do not change the design concept of intended performance.
- G. Regulatory Requirements: Aluminum-Framed Entrances and Storefront shall be listed and/or pre-approved by Texas Department of Insurance (TDI).

#### 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver and handle system components under provisions of SECTION 01 65 00 - PRODUCT DELIVERY REQUIREMENTS.
- B. Store and protect system components under provisions of SECTION 01 66 00 - PRODUCT STORAGE AND HANDLING REQUIREMENTS.
1. Provide wrapping to protect prefinished aluminum surfaces.

## 1.6 COORDINATION

- A. Manufacturer shall be responsible for details and dimensions not controlled by job conditions and shall show on his shop drawings required field measurements beyond his control.
- B. Coordinate with responsible trades to establish, verify and maintain field dimensions and job conditions.

## 1.7 ENVIRONMENTAL CONDITIONS

- A. Do not install sealants when ambient temperature is less than 40°F. during and 48-hours after installation.

## 1.8 WARRANTY

- A. Special Assembly Warranty: Manufacturer's standard form in which manufacturer agrees to repair or replace components of aluminum-framed systems that do not comply with requirements or that deteriorate within specified warranty period.
  - 1. Failures include, but are not limited to, the following:
    - a. Structural failures including, but not limited to, excessive deflection.
    - b. Noise or vibration caused by thermal movements.
    - c. Deterioration of metals, metal finishes, and other materials beyond normal weathering.
    - d. Water leakage through fixed glazing and framing areas.
    - e. Failure or operating components to function properly.
  - 2. Warranty Period: 2 years from date of substantial completion.

## PART 2 - PRODUCTS

### 2.1 MANUFACTURERS

- A. Products from the following will be acceptable, provided they equal the system identified.
  - 1. Oldcastle Building Envelope.
  - 2. Kawneer North America.
  - 3. Tubelite, Inc.

### 2.2 ACCEPTABLE PRODUCTS

- A. Exterior Basis of Design:
  - 1. Framing: Provide StormMax 5750T (TDI CWSF17), 2-1/2 X 5 inch, by Oldcastle Building Envelope for 1-5/16-inch glazing.
  - 2. Doors: Series WSD-500 StormMax impact resistant entrance doors by Oldcastle Building Envelope.
- B. Interior Basis of Design:
  - 1. Framing: Provide FG-3000, 2 X 4-1/2 inch, by Oldcastle Building Envelope for 1/4-inch and 9/16 inch glazing.
  - 2. Doors:
    - a. PerforMax Series 500 heavy-duty entrance system by Oldcastle Building Envelope.
    - b. All-Glass: Refer to Section 08 42 26 – All Glass Entrances.
- C. Subject to compliance with requirements of Texas Department of Insurance and /or Miami / Dade County BCCO.
  - 1. In compliance with the Texas Department of Insurance, hardware for exterior glazed aluminum curtainwall systems shall be provided and installed by the curtainwall manufacturer/installer as a total tested exterior entrance system assembly.

### 2.3 MATERIALS

- A. Extruded Aluminum: ASTM B 221; AA 6063-T5 alloy, temper.
  - 1. Sheet Aluminum: ASTM B 209; 5005-H34 alloy, temper; or other alloys and temper recommend by manufacturer appropriate for specified finish.
  - 2. Sheet Steel: ASTM A 446; hot-dipped galvanized.
  - 3. Steel Sections: ASTM A 36; shapes to suit mullion sections.
  - 4. Primer and Touch-Up Primer for Galvanized Surfaces: High-zinc-dust-content paint complying with SSPC-Paint 20.
  - 5. Fasteners: Stainless steel.

## 2.4 FABRICATED COMPONENTS

- A. General: Form section true to details with clean, straight, sharply defined profiles, free from defects impairing strength or durability.
- B. Framing:
  - 1. Fabricate the aluminum entrance and storefront systems with the shapes and sections detailed.
  - 2. Design the glass framing system to minimize loads on the glass due to building movement and incorporate provisions for thermal expansion by means of expansion joints. Where insulating glass is to be installed, design the glass framing system so that moisture does not accumulate in the glazing channel for prolonged periods.
  - 3. Construction: Mill joints to a hairline fit. Assemble and connect members to form rigid, watertight assemblies. No exposed fastenings will be permitted. Reinforce the framing internally as required to meet the design criteria specified above.
  - 4. Continuous Solid Closures: Fabricate required closures and covers to detail of aluminum sheet, plate, and angles. Provide solid continuous thermally-broken backer plate closures at head and all jams.
  - 5. Accessories: Provide glazing gaskets, flashing, and miscellaneous shims and other parts detailed or otherwise required to complete the work.
  - 6. Provide manufacturer's standard closure plate at perimeter framing members to cover open side of framing member against surrounding construction. Provide solid aluminum head channel at head condition per drawings.
- C. Doors.
  - 1. The aluminum doors shall be wide-stile type with 5" stiles, 6-1/2" top rail, 5" intermediate rail (centered on panic device) and 10¼" bottom rail; square glazing stops.
  - 2. Doors shall be mortised and have reinforced welded corner construction with hairline watertight joints. Fastenings shall be concealed.
  - 3. Extrusions shall have a minimum wall thickness of 3/16".
  - 4. Doors shall be factory fabricated by aluminum entrance and storefront manufacturer.
  - 5. Glazing Beads: Fixed or theft proof snap-in glazing beads on exterior or security side of doors. Interior glazing beads shall be snap-in type. All glazing beads shall have vinyl inserts and glazing gaskets.
  - 6. Weatherstripping: Continuous contact weatherstripping on stiles and top rails of exterior doors.
- D. Hardware Preparation: Prepare and reinforce doors and door frames for hardware.
  - 1. Mortising, reinforcing, drilling, and tapping for mortised hardware shall be done at the factory.
  - 2. Wherever possible, concealed steel reinforcement for surface-applied hardware shall be installed at the factory. The drilling and tapping for surface-applied hardware shall be done in the field.
- E. Reinforced Mullion: Same profile as non-reinforced frames, of extruded aluminum cladding with internal reinforcement of steel shaped structural section.
- F. Opaque Insulating Panels: Consisting of 0.032 Aluminum sheet laminated to 1/8 inch tempered hardboard each face of polyisocyanurate foam core; 1-inch thick; R-6; Kynar finish exterior and baked enamel interior.
  - 1. Acceptable Product: Mapes-R by Mapes Architectural Panels.
- G. Flashings:
  - 1. Form from sheet aluminum with same finish as extruded sections. Apply finish after fabrication. Material thickness as required to suit condition without deflection or "oilcanning"; of proper alloy to match the finished extrusions.
  - 2. Subsill Flashing: Provide manufacturer's standard high-performance, thermally broken aluminum subsill flashing with integral weep holes. End dams shall be manufacturer's standard fiberglass, plastic or thermally-broken aluminum end dams.
- H. Reinforcement: Concealed reinforcements for hardware in doors and frames and mullions shall be plated or galvanized steel and shall be secured in place. If Heavy Wall doors are not specified, then provide continuous reinforcement at continuous geared hinges.
- I. Fabricate doors and frames allowing for minimum clearances and shim spacing around perimeter of assembly yet enabling installation.
  - 1. Rigidly fit and secure joints and corners with internal reinforcement, except that door corners will be welded. Make joints and connections flush, hairline, and weatherproof.
  - 2. Develop drainage holes with moisture pattern to exterior.
  - 3. Prepare components to receive anchor devices. Fabricate anchorage items.
  - 4. Arrange fasteners, attachments, and jointing to ensure concealment from view.



5. Prepare components with internal reinforcement for door hardware.
6. Reinforce framing members for imposed loads.

## 2.5 HARDWARE

- A. Weatherstripping: Provide Kawneer's Polymeric Sealair Weathering System or approved equivalent, continuous at head, jamb, sill, and meeting stile.
1. Refer to SECTION 08 71 00 - DOOR HARDWARE for balance of hardware.

## 2.6 FINISHES

- A. Finish coating to conform to AAMA 611. Finish for aluminum entrances, storefronts, frames, doors and curtain wall shall match.
1. Aluminum Finish: Exposed aluminum surfaces of entrances, storefronts, frames, doors, curtain wall, and all their associated parts shall be Architectural Class I AA-M10C22A41 Clear Anodic Coating, .7 mil minimum. Screw and bolt heads exposed to view shall be finished to match the exposed aluminum surfaces.
  2. Concealed Steel Items: Galvanized in accordance with ANSI/ASTM A 123 to 2.0 oz/sq ft.
  3. Apply one coat of bituminous paint to concealed aluminum surfaces in contact with cementitious or dissimilar materials.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive entrances and storefronts for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.
1. Field check dimensions, elevations, and slopes on the connecting work affecting the entrance and storefront to assure a proper fit and weathertight installation.
  2. Verify that field measurements are as indicated on shop drawings and as instructed by the manufacturer.

### 3.2 INSTALLATION

- A. Install wall system, doors, and glazing in accordance with manufacturer's instructions and AAMA - Metal Curtain Wall, Window.
1. Erecting Storefronts: Erect the members to be plumb, level, square and in proper alignment with other work, and free from sags, waves and buckles.
  2. Materials shall be accurately cut and rigidly anchored in place to resist safely all normal stresses to which the work will be subjected.
  3. Cut and machined ends and recesses shall be true, accurate and free of burrs and rough edges.
  4. Provide subsill extrusions positioned to collect water leakage through mullions and storefront. Subsill shall drain to the exterior. It shall run continuously across the opening width. The ends are sealed with end dams.
  5. Create end dams at ends of window heads, sills, at edges of storefronts, and other vertical elements to channel water to nearest weep hole away from window mullions and other items which might allow water to travel vertically.
  6. Provide clearance around the perimeter between entrance and storefront metal and the opening substrate (concrete, masonry, or stucco) for caulking.
- B. Hanging Doors: Fit the doors with hardware and hang to operate smoothly, without bind or chatter.
1. Where concealed reinforcement for hardware cannot be provided, install and use Riv-Nuts for fastening surface applied hardware.
  2. Use sex bolts and nuts for fastening closers and closer arms to aluminum doors.
  3. The use of sheet metal or self-tapping screws to mount hardware is prohibited.
- C. Sealing Joints: Seal the metal-to-metal framing joints properly with butene tape and sealant in conformance with the manufacturer's standard procedure.
1. Pack fibrous insulation in shim spaces at perimeter of assembly to maintain continuity of thermal barrier.
  2. Install hardware using templates provided. Refer to SECTION 08 71 00 - DOOR HARDWARE for installation requirements.

3. Install glass and infill panels in accordance with SECTION 08 80 00 - GLAZING, using exterior dry method of glazing.
4. Install perimeter 2-part polyurethane type sealant, backing materials, and installation requirements in accordance with SECTION 07 92 00 - JOINT SEALANTS.

### 3.3 TOLERANCES

- A. Maximum Variation from Plumb: 0.06" every 3' non-cumulative or 1/16" per 10', whichever is less.
- B. Maximum Misalignment of Two Adjoining Members Abutting in Plane: 1/32".

### 3.4 ADJUSTING

- A. Adjust operating hardware for smooth operation.

### 3.5 PROTECT AND CLEAN

- A. Protection of Aluminum:
  1. Protect concealed aluminum surfaces that will contact masonry, concrete and steel with neoprene gaskets or a coat of bituminous paint to prevent galvanic and corrosive action.
  2. If drainage of moisture from incompatible metal passes over aluminum, paint the incompatible metal with a coat of aluminum pigmented paint.
  3. Protect finished aluminum surfaces from staining by gypsum and cement materials until all adjacent masonry and plaster work has been completed.
- B. Cleaning: Upon completion of the work, wash down aluminum surfaces with water and soft cloths and leave in first class condition.

### 3.6 FIELD QUALITY CONTROL

- A. Inspections: Aluminum-framed entrances and storefront materials, accessories, and installation are subject to inspection for compliance with requirements as set forth in the project documents and in the Building Envelope Commissioning construction checklists according to Quality Assurance Program schedule.

END OF SECTION

SECTION 08 80 00

GLAZING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Glass and glazing accessories.
- B. Related Sections:
  - 1. Section 08 11 00 - Hollow Metal Doors and Frames.

1.2 PERFORMANCE REQUIREMENTS

- A. Glass and glazing materials of this section shall provide continuity of building enclosure vapor and air barrier
  - 1. In conjunction with materials described in SECTION 07 92 00 - JOINT SEALANTS.
  - 2. Maintain continuous air and vapor barrier throughout glazed assembly from glass pane to heel bead of glazing sealant.
- B. Design and size glass to withstand dead loads and live loads caused by pressure and suction of wind as calculated in accordance with building code, and measured in accordance with ASTM E 330.
- C. Limit glass deflection to  $l/200$  or flexure limit of glass with full recovery of glazing materials, whichever is less.

1.3 SUBMITTALS

- A. Submit product data and samples under provisions of SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES.
- B. Provide structural, physical and environmental characteristics, size limitations, special handling or installation requirements.
- C. Provide data on glazing sealant. Identify colors available.
- D. Samples:
  - 1. Submit 2 samples of each type of glass (except clear glass), 12" x 12" in size, illustrating glass unit, coloration, design.
  - 2. Submit 4" long bead of glazing sealant in color selected.

1.4 QUALITY ASSURANCE

- A. Glazing Standards: Comply with recommendations of Glass Association of North America (GANA) "Glazing Manual."
- B. Source Quality Control: Glass shall be identified by the manufacturer's labels of grade and quality. Temporary labels shall not be removed until final cleaning. Permanent labels on tempered glass shall not be removed.
  - 1. Safety Glazing Labeling: Where safety glazing is indicated, permanently mark glazing with certification label of the SGCC or another certification agency acceptable to authorities having jurisdiction. Label shall indicate manufacturer's name, type of glass, thickness, and safety glazing standard with which glass complies.
  - 2. Insulating-Glass Certification Program: Permanently marked either on spacers or on at least one component lite of units with appropriate certification label of the IGCC.
- C. Safety Glazing Standard: Where safety glass is indicated or required, provide type of products indicated which comply with ANSI Z97.1 and testing requirements of CPSC 16 CFR Part 1201 for Category II materials.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Protect glass and glazing materials during delivery, storage, and handling as required to prevent edge damage to glass, and damage to glass and glazing materials from effects of moisture including condensation, or temperature changes, and other causes.

## 1.6 WARRANTY

- A. Provide written 10-year warranty signed by manufacturer of **insulating glass** agreeing to furnish replacements for those insulating glass units developing manufacturing defects. Manufacturing defects are defined as failure of hermetic seal of air space (beyond that due to glass breakage) as evidenced by intrusion of dirt or moisture, internal condensation or fogging, and other visual indications of seal failure or performance.
- B. Provide written 5-year warranty signed by manufacturer of **spandrel glass** agreeing to furnish replacements for those spandrel glass units developing defects of ceramic frit. Warranty covers deterioration due to normal conditions of use.
- C. Provide written 10-year warranty signed by manufacturer of **polycarbonate sheets** against breakage, yellowing, hazing, abrasion resistance, loss of light transmission, and coating failure of polycarbonate sheets.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Basis of Design products are **Vitro Architectural Glass (PPG)**: Provide glass as manufactured by one of the following:
  - AGC Glass North America
  - Guardian Industries Corp.
  - Technical Glass Products
  - Oldcastle Building Envelope
  - Pilkington North America, Inc. (NSG Group)
  - Vitro Architectural Glass (formerly PPG Glass)

### 2.2 GLASS

- A. (TT4) Tinted, Impact-Resistant, Insulated Windborne-Debris Glass: Provide Laminated Glass, two panes of glass, one of Class 1 (Clear) float glass and one of Class 2 (Tinted Heat-Absorb and Light-Reducing) (ASTM C 1036) of equal thickness, laminated together with not less than 0.09" thick polyvinyl butyl plastic interlayer to provide an overall thickness of 1-5/16". Fabricate laminated glass using laminator's standard heat- plus-pressure process to produce glass free from foreign substances and air/glass pockets.
  - 1. 1-5/16" thick Laminated Glass at Exterior Storefront:
    - a. Interior Pane Laminated Sandwich:
      - 1) Exterior Lite: Type I, Class 1 (Clear), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thick.
      - 2) Inner layer of 0.090 thick clear polyvinyl butyl plastic manufactured by Solutia Saflex or Dupont Butcite.
      - 3) Interior Lite: Type I, Class 1 (Clear), Quality q3 (Glazing select), Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thick.
    - b. 1/2" air space.
    - c. Exterior Pane: Type I, Class 2 - Vitro tint to match existing, (Tinted Heat-Absorbing and Light-Reducing), Quality q3 (Glazing select), Kind FT - Fully Tempered at entrances, 1/4" thick with low-emissivity Vitro Solarban 70 coating on the 2<sup>nd</sup> Surface.
    - d. Performance Characteristics: Low-E insulating glass shall comply with the following:
      - 1) SHGC: 0.20
      - 2) Visible Transmittance: 37
      - 3) Winter U-value: 0.28.
- B. (CT4) Clear, Tempered, Laminated Glass: Two panes of 1/8 inch Class 1 (Clear) FT glass (ASTM C 1036), laminated together with not less than 0.060" thick clear polyvinyl butyl plastic interlayer to provide an overall nominal thickness of 1/4 inch. Fabricate laminated glass using laminator's standard heat- plus-pressure process to produce glass free from foreign substances and air/glass pockets.

- C. (ST4) Clear, Tempered Glass: ASTM C 1048, Type I, Class 1 (Clear), Quality q3 (Glazing select). Kind FT - Fully Tempered, Condition A - Uncoated surfaces, 1/4" thickness.
- D. (BTG) Opaque Insulating Panel: See Section 08 41 13 – Aluminum-Framed Entrances and Storefronts.

## 2.3 GLAZING MATERIALS

- A. Glazing Compound: Comply with ASTM C 1311 or FS TT-S-00230, one-part, non-sag acrylic polymeric sealant. Product/manufacturer; one of the following:  
Acryl-R Acrylic Sealant; Schnee-Moorehead, Inc.  
Mono 555; Tremco
- B. Channel Glazing Strips; Hollow Metal Doors and Frames: Provide black vinyl channel glazing strips, Glazing Vinyl for 990 Sliders Part #6062-01 as manufactured by Kawneer.
- C. Accessories: Setting blocks, tape, vinyl gaskets and spacer strips as required for a complete installation.
- D. Glazing Sealant for Fire-Resistive Glazing Products: Identical to product used in test assembly to obtain fire-protection rating.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Examine areas to receive glass for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

### 3.2 INSTALLATION

- A. Setting Glass: Glazing shall be done at the site by skilled glaziers in conformance with the general conditions governing glazing in the GANA Glazing Manual.
  - 1. Glazing of aluminum windows and storefront shall be done in conformance with the methods recommended by the manufacturer of the aluminum items. Beads or stops furnished with the items to be glazed shall be used to secure the glass in place.
  - 2. For interior hollow metal door and frame glazing, install channel glazing strips and place glass within glazing strips. Install the removable stop and position the channel glazing strip to seal completely the void around the glass.
  - 3. Verify glass sizes for required edge clearances by measuring the openings. Cut each piece accurately and fit to its particular position. Center glass in the opening vertically and horizontally. Use edge blocks in vertical jambs to prevent lateral "walking" of the glass.
  - 4. Glass shall have clean cut edges. Do not seam, nip, stone or strike edges, or scarf corners, and do not install glass with flared edges at the bottom. Do not bump, drag, or rest the edge of a glass light against metal or other hard objects.
  - 5. Set tempered glass with tong marks completely concealed or in as inconspicuous a location as possible.

### 3.3 CLEANING

- A. Upon completion of the building, clean glass on both sides and remove labels, paint spots, putty and other defacement. Replace damaged glass with new.

END OF SECTION

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**SECTION 08 91 00**

**LOUVERS**

**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 SECTION INCLUDES**

- A. Louvers, frames, and accessories.

**1.3 RELATED REQUIREMENTS**

- A. Section 07 62 00 - Sheet Metal Flashing and Trim.
- B. Section 07 92 00 - Joint Sealants: Sealing joints between frames and adjacent construction.

**1.4 REFERENCE STANDARDS**

- A. AAMA 611 - Voluntary Specification for Anodized Architectural Aluminum; 2014 (2015 Errata).
- B. AMCA 500-L - Laboratory Methods of Testing Louvers for Rating; 2015.
- C. AMCA 511 - Certified Ratings Program for Air Control Devices; 2010.
- D. ASTM B221 - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes; 2014.
- E. ASTM B221M - Standard Specification for Aluminum and Aluminum-Alloy Extruded Bars, Rods, Wire, Profiles, and Tubes (Metric); 2013.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide data describing design characteristics, maximum recommended air velocity, design free area, materials and finishes.
- C. Shop Drawings: Indicate louver layout plan and elevations, opening and clearance dimensions, and tolerances; head, jamb and sill details; blade configuration, screens, blank-off areas required, and frames.
- D. Samples: Submit two samples 2 by 2 inches in size illustrating finish and color of exterior and interior surfaces.
- E. Test Reports: Independent agency reports showing compliance with specified performance criteria.
- F. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.
- G. Maintenance Data: Include lubrication schedules, adjustment requirements.

**1.6 QUALITY ASSURANCE**

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

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

## **1.7 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.
- B. Provide five year manufacturer's warranty against distortion, metal degradation, and connection failures of louver components.
  - 1. Finish: Include twenty year coverage against degradation of exterior finish.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Louvers:
  - 1. Airline Louvers: [www.airlinelouvers.com](http://www.airlinelouvers.com).
  - 2. Airolite Company, LLC: [www.airolite.com](http://www.airolite.com).
  - 3. American Warming and Ventilating: [www.awv.com](http://www.awv.com).
  - 4. Construction Specialties, Inc; Model No DC-5304: [www.c-sgroup.com](http://www.c-sgroup.com).
  - 5. Industrial Louvers, Inc; Model SP-537DC: [www.industriallouvers.com](http://www.industriallouvers.com).
  - 6. NCA, a brand of Metal Industries Inc: [www.ncamfg.com](http://www.ncamfg.com).
  - 7. Pottorff: [www.pottorff.com](http://www.pottorff.com).
  - 8. Louvers & Dampers, Inc.. Model IL-50

### **2.2 LOUVERS**

- A. Louvers: Factory fabricated and assembled, complete with frame, mullions, and accessories; AMCA Certified in accordance with AMCA 511.
  - 1. Wind Load Resistance: Design to resist positive and negative wind load of 25 psf without damage or permanent deformation.
  - 2. Intake Louvers: Design to allow maximum of 0.01 oz/sq ft water penetration at calculated intake design velocity based on design air flow and actual free area, when tested in accordance with AMCA 500-L.
  - 3. Drainable Blades: Continuous rain stop at front or rear of blade aligned with vertical gutter recessed into both jambs of frame.
  - 4. Screens: Provide insect screens at intake louvers and bird screens at exhaust louvers.
- B. Stationary Louvers: Horizontal blade, extruded aluminum construction, with intermediate mullions matching frame.
  - 1. Free Area: 50 percent, minimum.
  - 2. Pressure Drop: 1 inches of water gauge maximum per square foot of free area at velocity of 750 fpm, when tested in accordance with AMCA 500-L, test unit size 48 inch by 48 inch.



3. Blades: Straight.
4. Frame: Depth as indicated on drawings, channel profile; corner joints mitered and, with continuous recessed caulking channel each side.
5. Aluminum Thickness: Frame 12 gauge, 0.0808 inch minimum; blades 12 gauge, 0.0808 inch minimum.
6. Aluminum Finish: Superior performing organic coatings; finish welded units after fabrication.

## **2.3 MATERIALS**

- A. Extruded Aluminum: ASTM B221 (ASTM B221M), 6063 alloy, T6 temper.
- B. Formed Aluminum: Formed sheet, ASTM B209 (ASTM B209M), 3003 or 5005 alloy, forming temper.

## **2.4 FINISHES**

- A. Color: As indicated on drawings.

## **2.5 ACCESSORIES**

- A. Blank-Off Panels: Aluminum face and back sheets, polyisocyanurate foam core, 1-1/2 inch thick, painted black on exterior side; provide where duct connected to louver is smaller than louver frame, sealing off louver area outside duct.
- B. Screens: Frame of same material as louver, with reinforced corners; removable, screw attached; installed on inside face of louver frame.
- C. Insect Screen: 18 x 16 size aluminum mesh.
- D. Fasteners and Anchors: Stainless steel.
- E. Head and Sill Flashings: See Section 07 62 00.
- F. Sealant for Setting Sills and Sill Flashing: Non-curing butyl type.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that prepared openings and flashings are ready to receive this work and opening dimensions are as indicated on shop drawings.
- B. Verify that field measurements are as indicated on shop drawings.

### **3.2 INSTALLATION**

- A. Install louver assembly in accordance with manufacturer's instructions.
- B. Coordinate with installation of flashings by others.
- C. Install louvers level and plumb.
- D. Set sill members and sill flashing in continuous bead of sealant.
- E. Align louver assembly to ensure moisture shed from flashings and diversion of moisture to exterior.
- F. Secure louver frames in openings with concealed fasteners.

G. Coordinate with installation of mechanical ductwork.

H. Coordinate with installation of louver actuators.

**3.3 ADJUSTING**

A. Adjust operable louvers for freedom of movement of control mechanism. Lubricate operating joints.

**3.4 CLEANING**

A. Strip protective finish coverings.

B. Clean surfaces and components.

**END OF SECTION 08 91 00**

**SECTION 09 05 61**

**COMMON WORK RESULTS FOR FLOORING PREPARATION**

**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 SECTION INCLUDES**

- A. This section applies to floors identified in Contract Documents that are receiving the following types of floor coverings:
  - 1. Resilient flooring.
  - 2. Thin-set ceramic tile and stone tile.
  - 3. Athletic Flooring.
- B. Testing of concrete floor slabs for moisture and alkalinity (pH).
- C. Remediation of concrete floor slabs due to unsatisfactory moisture or alkalinity (pH) conditions.
  - 1. Contractor shall perform all specified remediation of concrete floor slabs. If such remediation is indicated by testing agency's report and is due to a condition not under Contractor's control or could not have been predicted by examination prior to entering into the contract, a contract modification will be issued.
- D. Patching compound.
- E. Remedial floor coatings.

**1.3 RELATED REQUIREMENTS**

- A. Section 01 40 00 - Quality Requirements: Additional requirements relating to testing agencies and testing.

**1.4 REFERENCE STANDARDS**

- A. ASTM F2170 - Standard Test Method for Determining Relative Humidity in Concrete Floor Slabs Using in situ Probes; 2019a.
- B. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate scheduling of cleaning and testing, so that preliminary cleaning has been completed for at least 24 hours prior to testing.

**1.6 SUBMITTALS**

- A. Testing Agency's Report:
  - 1. Description of areas tested; include floor plans and photographs if helpful.
  - 2. Summary of conditions encountered.
  - 3. Copies of specified test methods.

4. Recommendations for remediation of unsatisfactory surfaces.
5. Product data for recommended remedial coating.
6. Include certification of accuracy by authorized official of testing agency.
7. Submit report to Architect.
8. Submit report not more than two business days after conclusion of testing.

B. Copy of RFCI (RWP).

## **1.7 QUALITY ASSURANCE**

- A. Moisture and alkalinity (pH) testing shall be performed by an independent testing agency employed and paid by Contractor.
- B. Testing Agency Qualifications: Independent testing agency experienced in the types of testing specified.
  1. Submit evidence of experience consisting of at least 3 test reports of the type required, with project Owner's project contact information.
  2. Acceptable Testing Agencies:
    - a. Independent Floor Testing & Inspection, Inc. (IFTI): [www.ifti.com](http://www.ifti.com).
    - b. Substitutions: Not permitted.
- C. Contractor's Responsibility Relating to Independent Agency Testing:
  1. Provide access for and cooperate with testing agency.
  2. Confirm date of start of testing at least 10 days prior to actual start.
  3. Allow at least 4 business days on site for testing agency activities.
  4. Achieve and maintain specified ambient conditions.
  5. Notify Architect when specified ambient conditions have been achieved and when testing will start.
- D. Remedial Coating Installer Qualifications: Company specializing in performing work of the type specified in this section, trained by or employed by coating manufacturer, and able to provide at least 3 project references showing at least 3 years' experience installing moisture emission coatings.

## **1.8 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.

## **1.9 FIELD CONDITIONS**

- A. Maintain ambient temperature in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 65 degrees F or more than 85 degrees F.

- B. Maintain relative humidity in spaces where concrete testing is being performed, and for at least 48 hours prior to testing, at not less than 40 percent and not more than 60 percent.

## **PART 2 PRODUCTS**

## **PART 3 EXECUTION**

### **3.1 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.

### **3.2 INTERNAL RELATIVE HUMIDITY TESTING**

- A. Where the floor covering manufacturer's requirements conflict with either the referenced test method or this specification, comply with the manufacturer's requirements.
- B. Where this specification conflicts with the referenced test method, comply with the requirements of this section.
- C. Test in accordance with ASTM F2170 Procedure A and as follows.
- D. Testing with electrical impedance or resistance apparatus may not be substituted for the specified ASTM test method, as the values determined are not comparable to the ASTM test values and do not quantify the moisture content sufficiently.
- E. In the event that test values exceed floor covering manufacturer's limits, perform remediation as indicated. In the absence of manufacturer limits, perform remediation if any test value exceeds 75 percent relative humidity.
- F. Report: Report the information required by the test method.

### **3.3 PREPARATION**

- A. See individual floor covering section(s) for additional requirements.
- B. Comply with requirements and recommendations of floor covering manufacturer.
- C. Fill and smooth surface cracks, grooves, depressions, control joints and other non-moving joints, and other irregularities with patching compound.
- D. Do not fill expansion joints, isolation joints, or other moving joints.

### **3.4 PROTECTION**

- A. Cover prepared floors with building paper or other durable covering.

**END OF SECTION 09 05 61**

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**SECTION 09 21 16**

**GYPSUM BOARD ASSEMBLIES**

**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 SECTION INCLUDES**

- A. Performance criteria for gypsum board assemblies.
- B. Metal stud wall framing.
- C. Metal channel ceiling framing.
- D. Acoustic insulation.
- E. Cementitious backing board.
- F. Gypsum wallboard.
- G. Joint treatment and accessories.
- H. Textured finish system.
- I. Water-resistive barrier over exterior wall sheathing.

**1.3 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Wood blocking product and execution requirements.
- B. Section 07 84 00 - Firestopping: Top-of-wall assemblies at fire-resistance-rated walls.
- C. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.

**1.4 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. ANSI A108.11 - American National Standard Specifications for Interior Installation of Cementitious Backer Units; 2018.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ASTM C645 - Standard Specification for Nonstructural Steel Framing Members; 2018.
- E. ASTM C754 - Standard Specification for Installation of Steel Framing Members to Receive Screw-Attached Gypsum Panel Products; 2020.
- F. ASTM C840 - Standard Specification for Application and Finishing of Gypsum Board; 2019b.

- G. ASTM C1002 - Standard Specification for Steel Self-Piercing Tapping Screws for Application of Gypsum Panel Products or Metal Plaster Bases to Wood Studs or Steel Studs; 2018.
- H. ASTM C1047 - Standard Specification for Accessories For Gypsum Wallboard and Gypsum Veneer Base; 2019.
- I. ASTM C1178/C1178M - Standard Specification for Coated Glass Mat Water-Resistant Gypsum Backing Panel; 2018.
- J. ASTM C1396/C1396M - Standard Specification for Gypsum Board; 2017.
- K. ASTM D3273 - Standard Test Method for Resistance to Growth of Mold on the Surface of Interior Coatings in an Environmental Chamber; 2016.
- L. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- M. ASTM E413 - Classification for Rating Sound Insulation; 2016.
- N. GA-216 - Application and Finishing of Gypsum Panel Products; 2016.
- O. GA-600 - Fire Resistance Design Manual; 2015.
- P. UL (FRD) - Fire Resistance Directory; Current Edition.

## **1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings: Indicate special details associated with fireproofing.
- C. Product Data: Provide data on gypsum board, glass mat faced gypsum board, accessories, and joint finishing system.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Samples: Submit two samples of gypsum board finished with proposed texture application, 12 by 12 inches in size, illustrating finish color and texture.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing gypsum board installation and finishing, with minimum 5 years of experience.

## **PART 2 PRODUCTS**

### **2.1 GYPSUM BOARD ASSEMBLIES**

- A. Provide completed assemblies complying with ASTM C840 and GA-216.
  - 1. See PART 3 for finishing requirements.
- B. Interior Partitions, Indicated as Acoustic: Provide completed assemblies with the following characteristics:
  - 1. Acoustic Attenuation: STC of 45-49 calculated in accordance with ASTM E413, based on tests conducted in accordance with ASTM E90.
- C. Fire Rated Assemblies: Provide completed assemblies as indicated on drawings



1. UL Assembly Numbers: Provide construction equivalent to that listed for the particular assembly in the current UL (FRD).

## **2.2 METAL FRAMING MATERIALS**

### **A. Manufacturers - Metal Framing, Connectors, and Accessories:**

1. Clarkwestern Dietrich Building Systems LLC: [www.clarkdietrich.com](http://www.clarkdietrich.com).
2. Jaimes Industries: [www.jaimesind.com](http://www.jaimesind.com).
3. Marino: [www.marinoware.com](http://www.marinoware.com).
4. Phillips Manufacturing Co: [www.phillipsmfg.com](http://www.phillipsmfg.com).
5. SCAFCO Corporation: [www.scafco.com](http://www.scafco.com).
6. Steel Construction Systems: [www.steelconsystems.com](http://www.steelconsystems.com).
7. Substitutions: See Section 01 60 00 - Product Requirements.

### **B. Non-Loadbearing 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/240 at 5 psf.**

1. Studs: "C" shaped with flat or formed webs.
2. Runners: U shaped, sized to match studs.
3. Ceiling Channels: C-shaped.
4. Furring Members: Hat-shaped sections, minimum depth of 7/8 inch.
5. Resilient Furring Channels: Single or double leg configuration; 1/2 inch channel depth.

#### **a. Products:**

- 1) Same manufacturer as other framing materials.

### **C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.**

1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
2. Material: ASTM A653/A653M steel sheet, SS Grade 50/340, with G60/Z180 hot-dipped galvanized coating.
3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
4. Provide mechanical anchorage devices as described above that accommodate deflection while maintaining the fire-resistance rating of the wall assembly.

#### **a. Products:**

- 1) ClarkDietrich; BlazeFrame RipTrak: [www.clarkdietrich.com](http://www.clarkdietrich.com).
- 2) FireTrak Corporation; Posi Klip: [www.fire-trak.com](http://www.fire-trak.com).

- 3) Metal-Lite, Inc; The System: [www.metal-lite.net](http://www.metal-lite.net).
  - 4) Super Stud Building Products, Inc; Slotted Deflection Track: [www.buysuperstud.com](http://www.buysuperstud.com).
  - 5) Substitutions: See Section 01 60 00 - Product Requirements.
5. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- D. Non-structural Framing Accessories:
1. Ceiling Hangers: Type and size as specified in ASTM C754 for spacing required.
  2. Framing Connectors: ASTM A653/A653M G90 galvanized steel clips; secures cold rolled channel to wall studs for lateral bracing.
    - a. Products:
      - 1) ClarkDietrich; FastBridge Clip (FB33): [www.clarkdietrich.com](http://www.clarkdietrich.com).
      - 2) Substitutions: See Section 01 60 00 - Product Requirements.

## 2.3 BOARD MATERIALS

- A. Gypsum Wallboard: 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. Mold Resistance: Score of 10, when tested in accordance with ASTM D3273.
    - a. Mold-resistant board is required whenever board is being installed before the building is enclosed and conditioned.
    - b. Mold resistant board is required at all locations.
  3. At Assemblies Indicated with Fire-Resistance Rating: Use type required by indicated tested assembly; if no tested assembly is indicated, use Type X board, UL or WH listed.
  4. Thickness:
    - a. Vertical Surfaces: 5/8 inch.
    - b. Ceilings: 5/8 inch.
    - c. Multi-Layer Assemblies: Thicknesses as indicated on drawings.
  5. Mold Resistant Paper Faced Products:
    - a. American Gypsum Company; M-Bloc Type X: [www.americangypsum.com](http://www.americangypsum.com).
    - b. CertainTeed Corporation; M2Tech 5/8" Type X Moisture & Mold Resistant Drywall: [www.certainteed.com](http://www.certainteed.com).
    - c. Continental Building Products; Mold Defense Type X: [www.continental-bp.com](http://www.continental-bp.com).
    - d. Georgia-Pacific Gypsum; ToughRock Fireguard X Mold-Guard: [www.gpgypsum.com](http://www.gpgypsum.com).
    - e. National Gypsum Company; Gold Bond XP Fire Shield Gypsum Board.
    - f. USG; Sheetrock Brand Mold Tough Firecode Core Gypsum Panel.

- g. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Backing Board For Wet Areas:
  - 1. Application: Surfaces behind tile in wet areas including shower ceilings and Restrooms.
  - 2. Glass Mat Faced Board: Coated glass mat water-resistant gypsum backing panel as defined in ASTM C1178/C1178M.
    - a. Fire-Resistance-Rated Type: Type X core, thickness 5/8 inch.
    - b. Products:
      - 1) Georgia-Pacific Gypsum; DensShield Tile Backer: [www.gpgypsum.com](http://www.gpgypsum.com).
      - 2) National Gypsum Company; Gold Bond eXP Tile Backer: [www.nationalgypsum.com](http://www.nationalgypsum.com).
- C. Ceiling Board: Special sag resistant gypsum ceiling board as defined in ASTM C1396/C1396M; sizes to minimize joints in place; ends square cut.
  - 1. Application: Ceilings, unless otherwise indicated.
  - 2. Thickness: 5/8 inch.
  - 3. Edges: Tapered.
  - 4. Products:
    - a. Continental Building Products; Sagcheck. Type X.
    - b. Georgia-Pacific Gypsum; ToughRock Span 24 Ceiling Board. Type X.
    - c. Substitutions: See Section 01 60 00 - Product Requirements.

## 2.4 GYPSUM WALLBOARD ACCESSORIES

- A. Acoustic Sealant: Acrylic emulsion latex or water-based elastomeric sealant; do not use solvent-based non-curing butyl sealant.
  - 1. Products:
    - a. Franklin International, Inc; Titebond GREENchoice Professional Acoustical Smoke and Sound Sealant: [www.titebond.com](http://www.titebond.com).
    - b. Liquid Nails, a brand of PPG Architectural Coatings: [www.liquidnails.com](http://www.liquidnails.com).
- B. Beads, Joint Accessories, and Other Trim: ASTM C1047, rolled zinc, unless noted otherwise.
  - 1. Corner Beads: Low profile, for 90 degree outside corners.
    - a. Products:
      - 1) Phillips Manufacturing Co; Everlast Corner Bead: [www.phillipsmfg.com](http://www.phillipsmfg.com).
      - 2) Trim-Tex, Inc: [www.trim-tex.com](http://www.trim-tex.com).
  - 2. L-Trim with Tear-Away Strip: Sized to fit 1/2 inch thick gypsum wallboard.
    - a. Products:
      - 1) Phillips Manufacturing Co; gripSTIK L-Tear: [www.phillipsmfg.com](http://www.phillipsmfg.com).

- 3. Expansion Joints:
  - a. Type: V-shaped metal with factory-installed protective tape.
  - b. Products:
    - 1) Phillips Manufacturing Co; 093 Expansion Control Joint: [www.phillipsmfg.com](http://www.phillipsmfg.com).
    - 2) Trim-Tex, Inc: [www.trim-tex.com](http://www.trim-tex.com).
- C. Screws for Fastening of Gypsum Panel Products to Cold-Formed Steel Studs Less than 0.033 inches in Thickness and Wood Members: ASTM C1002; self-piercing tapping screws, corrosion-resistant.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that project conditions are appropriate for work of this section to commence.

#### **3.2 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.
  - 3. Install bracing as required at exterior locations to resist wind uplift.
- C. Studs: Space studs at 16 inches 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 top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- D. Openings: Reinforce openings as required for weight of doors or operable panels, using not less than double studs at jambs.
- E. Standard Wall Furring: Install at concrete and masonry walls scheduled to receive gypsum board, not more than 4 inches from floor and ceiling lines and abutting walls. Secure in place on alternate channel flanges at maximum 24 inches on center.
  - 1. Orientation: Horizontal.
  - 2. Spacing: At 16 inches on center.
- F. Furring for Fire-Resistance Ratings: Install as required for fire-resistance ratings indicated and to GA-600 requirements.
- G. Blocking: Install wood blocking for support of:

1. Wall-mounted cabinets.
2. Plumbing fixtures.
3. Toilet partitions.
4. Toilet accessories.
5. Wall-mounted door hardware.

### **3.3 ACOUSTIC ACCESSORIES INSTALLATION**

- A. Acoustic Insulation: Place tightly within spaces, around cut openings, behind and around electrical and mechanical items within partitions, and tight to items passing through partitions.
- B. Acoustic Sealant: Install as follows:
  1. Place one bead continuously on substrate before installation of perimeter framing members.
  2. Place continuous bead at perimeter of each layer of gypsum board.
  3. Seal around all penetrations by conduit, pipe, ducts, rough-in boxes, and openings, except where firestopping is provided.

### **3.4 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. Single-Layer Nonrated: Install gypsum board in most economical direction, with ends and edges occurring over firm bearing.
  1. Exception: Tapered edges to receive joint treatment at right angles to framing.
- C. Double-Layer, Nonrated: Use gypsum board for first layer, placed parallel to framing or furring members, with ends and edges occurring over firm bearing. Use glass mat faced gypsum board at exterior walls and at other locations as indicated. Place second layer perpendicular to framing or furring members. Offset joints of second layer from joints of first layer.
- D. Fire-Resistance-Rated Construction: Install gypsum board in strict compliance with requirements of assembly listing.
- E. Exposed Gypsum Board in Interior Wet Areas: Seal joints, cut edges, and holes with water-resistant sealant.
- F. Cementitious Backing Board: Install over steel framing members where indicated, in accordance with ANSI A108.11 and manufacturer's instructions.
- G. Installation on Metal Framing: Use screws for attachment of gypsum board except face layer of nonrated double-layer assemblies, which may be installed by means of adhesive lamination.

### **3.5 INSTALLATION OF TRIM AND ACCESSORIES**

- A. Control Joints: Place control joints consistent with lines of building spaces and as indicated.
  1. Not more than 30 feet apart on walls and ceilings over 50 feet long.
- B. Corner Beads: Install at external corners, using longest practical lengths.

- C. Edge Trim: Install at locations where gypsum board abuts dissimilar materials.
- D. Decorative Trim: Install at locations shown on drawings and in accordance with manufacturer's instructions.

### **3.6 JOINT TREATMENT**

- A. Glass Mat Faced Gypsum Board and Exterior Glass Mat Faced Sheathing: Use fiberglass joint tape, embed and finish with setting type joint compound.
- B. Finish gypsum board in accordance with levels defined in ASTM C840, as follows:
  - 1. Level 5: Walls and ceilings to receive semi-gloss or gloss paint finish and other areas specifically indicated.
  - 2. Level 4: Walls and ceilings to receive paint finish or wall coverings, unless otherwise indicated.
  - 3. Level 3: Walls to receive textured wall finish.
  - 4. Level 2: In utility areas, behind cabinetry, and on backing board to receive tile finish.
  - 5. Level 1: Fire-resistance-rated wall areas above finished ceilings, whether or not accessible in the completed construction.
  - 6. Level 0: Temporary partitions.
  - 7. Level 0: Surfaces indicated to be finished in later stage of project.
- C. Tape, fill, and sand exposed joints, edges, and corners to produce smooth surface ready to receive finishes.
  - 1. Feather coats of joint compound so that camber is maximum 1/32 inch.
  - 2. Taping, filling, and sanding are not required at surfaces behind adhesive applied ceramic tile and fixed cabinetry.
  - 3. Taping, filling, and sanding are not required at base layer of double-layer applications.
- D. Where Level 5 finish is indicated, spray apply high build drywall surfacer over entire surface after joints have been properly treated; achieve a flat and tool mark-free finish.
- E. Fill and finish joints and corners of cementitious backing board as recommended by manufacturer.

### **3.7 TEXTURE FINISH**

- A. Apply finish texture coating by means of spraying apparatus in accordance with manufacturer's instructions and to match approved sample.

### **3.8 TOLERANCES**

- A. Maximum Variation of Finished Gypsum Board Surface from True Flatness: 1/8 inch in 10 feet in any direction.

**END OF SECTION 09 21 16**

**SECTION 09 22 16**

**NON-STRUCTURAL METAL FRAMING**

**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 SECTION INCLUDES**

- A. Metal partition and ceiling framing.
- B. Framing accessories.

**1.3 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Metal fabrications attached to stud framing.
- B. Section 05 50 00 - Metal Fabrications: Execution requirements for anchors for attaching work of this section.
- C. Section 07 84 00 - Firestopping: Sealing top-of-wall assemblies at fire-resistance-rated walls.
- D. Section 07 92 00 - Joint Sealants: Sealing acoustical gaps in construction other than gypsum board or plaster work.
- E. Section 08 31 00 - Access Doors and Panels.
- F. Section 09 21 16 - Gypsum Board Assemblies: Execution requirements for anchors for attaching work of this section.

**1.4 REFERENCE STANDARDS**

- A. AISI S100 - North American Specification for the Design of Cold-Formed Steel Structural Members; 2016, with Supplement (2018).
- B. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- 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 E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).
- F. ASTM E413 - Classification for Rating Sound Insulation; 2016.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Shop Drawings:
  - 1. Indicate prefabricated work, component details, stud layout, framed openings, anchorage to structure, acoustic details, type and location of fasteners, accessories, and items of other related work.

2. Describe method for securing studs to tracks, splicing, and for blocking and reinforcement of framing connections.
- C. Product Data: Provide data describing framing member materials and finish, product criteria, load charts, and limitations.
- D. Product Data: Provide manufacturer's data on partition head to structure connectors, showing compliance with requirements.
- E. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- F. Sustainable Design Submittal: Documentation of recycled content and location of manufacture.

## **1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in performing the work of this section with minimum five years documented experience and approved by manufacturer.

## **1.7 MOCK-UP**

- A. Provide mock-up of stud wall, ceiling, and soffit framing including insulation, sheathing, window frame, and door frame and finish specified in other sections. Coordinate with installation of associated work specified in other sections.
  1. Mock-up Size: Full-height, minimum 12 feet long, including corner.
  2. Mock-up may remain as part of the Work.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Metal Framing, Connectors, and Accessories:
  1. CEMCO: [www.cemcosteel.com](http://www.cemcosteel.com).
  2. ClarkDietrich Building Systems: [www.clarkdietrich.com](http://www.clarkdietrich.com).
  3. Jaimes Industries: [www.jaimesind.com](http://www.jaimesind.com).
  4. Marino: [www.marinoware.com](http://www.marinoware.com).
  5. SCAFCO Corporation: [www.scafco.com](http://www.scafco.com).
  6. Simpson Strong Tie: [www.strongtie.com](http://www.strongtie.com).
  7. Steel Construction Systems: [www.steelconsystems.com](http://www.steelconsystems.com).
  8. The Steel Network, Inc: [www.SteelNetwork.com](http://www.SteelNetwork.com).
  9. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.2 FRAMING MATERIALS**

- A. Fire Rated Assemblies: Comply with applicable code and as indicated on drawings.



- B. Non-Loadbearing 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/240 at 10 psf.
  - 1. Studs: C shaped with flat or formed webs.
  - 2. Runners: U shaped, sized to match studs.
  - 3. Ceiling Channels: C shaped.
  - 4. Furring: Hat-shaped sections, minimum depth of 7/8 inch.
- C. Partition Head to Structure Connections: Provide mechanical anchorage devices that accommodate deflection using slotted holes, screws, and anti-friction bushings, preventing rotation of studs while maintaining structural performance of partition.
  - 1. Structural Performance: Maintain lateral load resistance and vertical movement capacity required by applicable code, when evaluated in accordance with AISI S100.
  - 2. Material: ASTM A653/A653M steel sheet, SS Grade 50, with G60/Z180 hot-dipped galvanized coating.
  - 3. Provide components UL-listed for use in UL-listed fire-resistance-rated head of partition joint systems indicated on drawings.
  - 4. Provide top track preassembled with connection devices spaced to fit stud spacing indicated on drawings; minimum track length of 12 feet.
- D. Deflection and Firestop Track: Intumescent strip factory-applied to track flanges expands when exposed to heat or flames to provide a perimeter joint seal.
  - 1. Products:
    - a. ClarkDietrich; BlazeFrame Firestop Deflection Track: [www.clarkdietrich.com](http://www.clarkdietrich.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.3 FABRICATION**

- A. Fabricate assemblies of framed sections to sizes and profiles required.
- B. Fit, reinforce, and brace framing members to suit design requirements.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that rough-in utilities are in proper location.

### **3.2 INSTALLATION OF STUD FRAMING**

- A. Comply with requirements of ASTM C754.
- B. Extend partition framing to structure where indicated and to ceiling in other locations.
- C. Partitions Terminating at Ceiling: Attach ceiling runner securely to ceiling track in accordance with manufacturer's instructions.

- D. Partitions Terminating at Structure: Attach top runner to structure, maintain clearance between top of studs and structure, and connect studs to track using specified mechanical devices in accordance with manufacturer's instructions; verify free movement of top of stud connections; do not leave studs unattached to track.
- E. Align and secure top and bottom runners at 24 inches on center.
- F. At partitions indicated with an acoustic rating:
  - 1. Provide components and install as required to produce STC ratings as indicated, based on published tests by manufacturer conducted in accordance with ASTM E90 with STC rating calculated in accordance with ASTM E413.
  - 2. Place one bead of acoustic sealant between runners and substrate, studs and adjacent construction.
  - 3. Place one bead of acoustic sealant between studs and adjacent vertical surfaces.
- G. Fit runners under and above openings; secure intermediate studs to same spacing as wall studs.
- H. Install studs vertically at 16 inches on center.
- I. Align stud web openings horizontally.
- J. Secure studs to tracks using fastener method. Do not weld.
- K. Stud splicing is not permissible.
- L. Fabricate corners using a minimum of three studs.
- M. Install double studs at wall openings, door and window jambs, not more than 2 inches from each side of openings.
- N. Brace stud framing system rigid.
- O. Coordinate erection of studs with requirements of door frames; install supports and attachments.
- P. Coordinate installation of bucks, anchors, and blocking with electrical, mechanical, and other work to be placed within or behind stud framing.
- Q. Blocking: Use wood blocking secured to studs. Provide blocking for support of plumbing fixtures, toilet partitions, wall cabinets, toilet accessories, hardware, and opening frames.
- R. Furring: Install at spacing and locations shown on drawings. Lap splices a minimum of 6 inches.

### **3.3 TOLERANCES**

- A. Maximum Variation From True Position: 1/8 inch in 10 feet.
- B. Maximum Variation From Plumb: 1/8 inch in 10 feet.

**END OF SECTION 09 22 16**

**SECTION 09 30 00**

**TILING**

**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. Ceramic/Porcelain Tile.
  - 2. Tile Trim and Accessories.
  - 3. Related Sections:
    - a. Section 09 21 16 - Gypsum Board Assemblies.

**1.3 SUBMITTALS**

- A. Samples: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES. Tile samples shall be size scheduled for each particular type of tile required.
  - 1. Certificate: Furnish one master grade certificate on ceramic tile executed prior to delivery of the tile to the site.

**1.4 QUALITY ASSURANCE**

- A. Standard: Ceramic tile shall be Standard Grade complying with the requirements of ANSI A 137.1. Deliver tile to the project site in grade sealed containers.

**1.5 PROJECT CONDITIONS**

- A. Environmental Limitations: Do not install tile until construction in spaces is completed and ambient temperature and humidity conditions are being maintained.
- B. Do not install adhesives in a closed, unventilated environment.
- C. Maintain 50°F. during installation of mortar materials.

**1.6 MAINTENANCE**

- A. Extra Materials: Upon completion of work, deliver to the project site one box for each type, color, pattern, and size of ceramic tile installed. Furnish maintenance materials from same manufactured lot as materials installed and enclose in protective packaging with appropriate identifying labels.

**PART 2 - PRODUCTS**

**2.1 TILE**

- A. Basis of Design: Dal-Tile Classic.

- B. Manufacturers: Ceramic tile and trim as manufactured by American Olean, Dal-Tile Corp., Interceramic, and Crossville Ceramics shall set all standards in the areas of trim shapes availability, tile size, color, pattern, and texture.
- C. Ceramic and Porcelain Tile: Reference "Material Finish Schedule" in drawings for manufacturer, product, color and finish of tile.
- D. Trim Pieces:
  - 1. Provide factory made fitters and trim shapes required for a finished installation. Keep job-cut fitters and trim shapes to a minimum. Provide bullnose tile at horizontal and vertical tile edges.
  - 2. Floor Tile Wet Dynamic Coefficient of Friction: Not less than 0.42, when tested in conformance with ANSI A137.1.

## **2.2 MORTAR MATERIALS**

- A. Portland Cement: ASTM C 150, domestic manufacture.
- B. Dry-Set Mortar: ANSI A 118.1, factory sanded mortar mix.
- C. Latex-Portland Cement: ANSI A 118.15, flexible mortar consisting of cement-based mix and latex additive.
- D. Adhesive: ANSI A 136.1, Type I, prepared organic adhesive.
- E. Grout:
  - 1. Floor: ANSI A118.6, latex modified dry-set Portland cement or commercial waterproof Portland cement grout. Provide grout as manufactured by Custom Building Products, Laticrete, Mapei or approved equivalent. Color(s) shall be as scheduled "Material Finish Schedule" in drawings.
  - 2. Walls: Modified acrylic, premixed Mastic Grout or dry-set grout complying with ANSI A118.6. Provide grout as manufactured by Custom Building Products, Laticrete, Mapei or approved equivalent. Color(s) shall be as scheduled in "Material Finish Schedule" in drawings. If Contractor elects to provide dry-set grout, the installation shall be damp cured.
- F. Lime: ASTM C 207, Type S, hydrated lime.
- G. Sand: ASTM C 35, clean, sharp plaster sand.
  - 1. Water: Clean and potable.

## **2.3 ADHESIVE/WATERPROOF MEMBRANE**

- A. Urethane Waterproofing and Tile-setting Adhesive: One-part liquid-applied urethane in a consistency suitable for trowel application and intended for use as both waterproofing and tile-setting adhesive in a two- step process. Product/manufacturer; one of the following:
  - 1. Hydroment Ultra-Set; Bostik
  - 2. Deck-Seal 1000; Southern Grouts & Mortars, Inc.

## **2.4 CRACK ISOLATION MEMBRANE**

- A. General: Manufacturer's standard product that complies with ANSI A118.12 for standard performance and is recommended by the manufacturer for the application indicated.

1. Contractor's Option: Provide either tile manufacturer's standard product as stated above, or the following product:
  - a. Chlorinated Polyethylene Sheet: Non-plasticized elastomer with non-woven polyester laminated to both sides, nominal 0.030" thickness. Product/manufacturer; NobleSeal CIS; Noble Co.

## **2.5 SHOWER PAN**

- A. Shower Pan: Provide one of the following or approved equal 40-mil thick crack isolation and waterproofing sheet membranes at thinset tile applications:
  1. Composeal Gold Membrane; Compotite Corp.
  2. NobleSeal TS Membrane; Noble Co. (Div of Federal Process Corp.)

## **2.6 BACKER BOARD**

- A. Tile Backer Board: ASTM C 1178:
  1. Installation under ceramic tile on steel studs at shower locations.
  2. At accessible shower ceilings, unless cement plaster is indicated.
  3. Provide one of the following Products/Manufacturers:
    - a. 5/8" Diamondback GlasRoc Type X Tile Backer; CertainTeed Gypsum 5/8" DensShield Fireguard Type X Tile Backer; Georgia-Pacific Corp
    - b. 5/8" Gold Bond Brand eXP Type X Tile Backer; National Gypsum Company 5/8" Durock Brand Glass-Mat Type X Tile Backer; USG Corporation

## **2.7 ACCESSORIES**

- A. Metal Floor and Wall Transition Trim: Provide protective edge trim by Schluter Systems L.P. Profiles and finishes shall be as scheduled in "Material Finish Schedule" in drawings. Height as required to flush out with top of tile flooring.
- B. Metal Corner Trim: Provide Jolly-AC color coated aluminum corner trim by Schluter System. Color to be selected from manufacturers complete color range.

## **PART 3 - EXECUTION**

### **3.1 PREPARATION**

- A. Sweep concrete slab surfaces clean and free of dirt and debris. Remove oil, grease, paint, and dried mortar.
- B. Concrete Slab-on-grade: Install crack isolation membrane to comply with ANSI A108.17 and manufacturer's written instructions and recommendations to produce membrane bonded securely to substrate.
- C. Shower Pan Membrane Installation:
  1. Coat surface to receive membrane waterproofing with a minimum 3/16" thick coat of bond coat adhesive and in accordance with manufacturer's recommendation and ANSI A 108.5.
  2. Provide PVC solvent cement welding of all seams and penetrations including drains.
  3. Provide factory fabricated pre-molded inside and outside corners.

- D. Shower Wall Tile Base: At showers, install tile backer board. Apply with un-cut long edge at bottom of work. Fasten boards to steel stud framing with Type S bugle head drywall screws spaced 6" o.c. Space fasteners at least 3/8" from edge of board.

### 3.2 INSTALLATION

A. General Workmanship:

1. Center and balance areas of tile, if possible.
2. Do not make an excessive amount of cuts. Usually, no cuts smaller than half size should be made. Make all cuts on the outer edges of the field.
3. Smooth cut edges. Install tile without jagged or flaked edges.
4. Fit tile closely where edges will be covered by trim, escutcheons or other similar devices.
5. The splitting of tile is expressly prohibited except where no alternative is possible.
6. Maintain the heights of tilework in full courses to the nearest obtainable dimension where heights, given in feet and inches, are not required to fill vertical spaces exactly.
7. Make corners of all tile flush and level with corners of adjacent tile, with due allowance to tolerances for tile as specified in ANSI A137.1.
8. Keep all joint lines straight and even width, including miters.
9. Thoroughly back-up with thin-set bonding material all thin-set units, molded or shaped pieces; secure firmly in place.
10. Thoroughly back-up with mortar-bed mix thick-bed nosings, coves, curbing, gutters, flat tile and trimmers, molded or shaped pieces; secure firmly in place.
11. Bond coat mix shall not be used to back-up thick-bed trim and angles. Coat all thick-bed trim shapes with 1/32" to 1/16" of bond coat mix.
12. Finish floor and wall areas level and plumb with no variations exceeding 1/8" in 8' from the required plane.
13. Install accessories in tile work to be evenly spaced, properly centered with tile joints, and level, plumb and true to the correct projection. Install accessories at locations and heights designated.
14. Finished tile work shall be clean. Replace pitted, chipped, cracked and scratched tiles.
15. Maximum grout joint 1/4".

B. Setting Floor Tile - Thinset:

1. Set floor tile in straight joint pattern using dry-set cement mortar in conformance with ANSI A 108.5.
2. Mix and apply dry-set mortar in conformance with the manufacturer's recommendations. Cover surface evenly and comb with a notched trowel not more than 10 minutes before applying tile.
3. Set tile before initial set of the mortar has taken place. Press and beat tile firmly into place to establish proper and complete bond. Joints shall be close and uniform.

C. Setting Wall Tile:

1. Set base and wall tile over masonry in straight joint pattern using dry-set cement mortar in conformance with ANSI A 108.5.
2. Set base and wall tile of size less than 12" x 12" over gypsum wallboard in straight joint pattern using organic adhesive in conformance with TCA W242 and ANSI A 108.4.
3. Set base and wall tile of size more than 12" x 12" over gypsum wallboard in straight joint pattern using Latex Portland cement mortar in conformance with TCA W243 and ANSI A 108.5.
4. Surfaces to be tiled shall be dry, firm and proper for bond.
  - a. Treat gypsum wallboard surfaces with a primer-sealer; caulk openings around pipes and fixtures with a non-hardening waterproof sealant.
  - b. Apply leveling coat of sanded dry-set mortar over irregular surfaces if and as required to secure plumb, flat surfaces for the application of tile.
  - c. Mix and apply mortar and adhesive in conformance with best trade practice and the recommendations of the manufacturer of the materials used. Cover surfaces evenly, with no bare spots, and comb with a notched trowel within 10 minutes of applying tile.
  - d. Apply tile before skinning of the adhesive or mortar has taken place. Press and beat firmly into place to obtain at least 75 percent contact area of adhesive or mortar on the tile back.
  - e. If tile is face mounted, remove paper and glue before the adhesive or mortar is firmly set; adjust tiles that are out of line.
  - f. Provide control joints at all inside corners of wall tile areas. Install sealant in joint. Color as selected by Architect.

D. Grouting:

1. Force a maximum amount of grout into the joints.
2. Clean the joints of cushion-edge tile to depth of cushion. Fill joints of square-edge tile flush with face of tile.
3. Fill all gaps and skips. Mortar shall not show through grouted joints.
4. Finished grout shall be uniform in color, smooth, and without voids and low spots.
5. Grout joint width as recommended by tile manufacturer.
6. Damp cure Portland cement grout for at least 72 hours.

E. Wall Control Joints:

1. Provide a caulked control joint at same width as grout joints, minimum of 1/8".
2. After tile work and grout are dry, clean the open control joint and roll-in foam rod stock to leave a joint depth of 1/4".
3. Fill the joint with primerless one-part acrylic polymeric sealant. Color shall be as selected by Architect.
4. Tool the sealant smooth.
5. Where tile on wallboard abuts tile on masonry, provide a 1/4" caulked control joint to separate the two areas.

F. Joints at Frames: Where 4-1/4" x 4-1/4" ceramic tile abuts frame, provide a 1/8" caulked expansion joint to separate tile from the frame. Where 6" x 6" ceramic tile abuts frame, provide a 1/4" caulked expansion joint to separate tile from the frame.

1. After tile work and grout are dry, clean the joint at the frame.
2. Fill the joint with primerless one-part acrylic polymeric sealant equal to "Mono 555" by Tremco.
3. Color shall match adjacent grout.
4. Tool the sealant smooth.

G. Metal Floor Transition Trim:

1. Provide at transition of ceramic floor tile to lower flooring material (e.g. vinyl composition tile, exposed concrete, etc.) where no marble threshold is detailed.
2. Install as detailed on drawings.
3. Set transition trim prior to installing ceramic floor tile.
4. Set tile up tight to transition trim with a factory cushion edge. Trim shall be flush with top of ceramic tile.
5. After tile work and grout are dry, clean the joint between the trim and the tile.
6. Fill joint between trim and ceramic floor tile with sealant to match grout.

### **3.3 CLEANING**

A. When the work of other trades is completed, clean down tile and marble surfaces and leave in first class condition.

1. The use of wire brushes or acids is expressly prohibited.
2. Replace cracked, broken, and chipped tile with new units.
3. Correct uneven and stained joints.

**END OF SECTION 09 30 00**



**SECTION 09 51 00**

**ACOUSTICAL CEILINGS**

**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 SECTION INCLUDES**

- A. Suspended metal grid ceiling system.
- B. Acoustical units.
- C. Supplementary acoustical insulation above ceiling.

**1.3 RELATED REQUIREMENTS**

- A. Section 07 21 00 - Thermal Insulation: Acoustical insulation.
- B. Section 08 31 00 - Access Doors and Panels: Access panels.

**1.4 REFERENCE STANDARDS**

- A. ASTM C635/C635M - Standard Specification for the Manufacture, Performance, and Testing of Metal Suspension Systems for Acoustical Tile and Lay-in Panel Ceilings; 2017.
- B. ASTM C636/C636M - Standard Practice for Installation of Metal Ceiling Suspension Systems for Acoustical Tile and Lay-in Panels; 2013.
- C. ASTM E1264 - Standard Classification for Acoustical Ceiling Products; 2019.
- D. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

**1.5 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.

**1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Shop Drawings: Indicate grid layout and related dimensioning, junctions with other ceiling finishes, and mechanical and electrical items installed in the ceiling.
- C. Product Data: Provide data on suspension system components and acoustical units.
- D. Samples: Submit two full size samples illustrating material and finish of acoustical units.
- E. Samples: Submit two samples each, 6 inches long, of suspension system main runner, cross runner, and perimeter molding.

- F. Manufacturer's Installation Instructions: Indicate special procedures and perimeter conditions requiring special attention.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
  - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
  - 2. Extra Acoustical Units: Quantity equal to 5 percent of total installed.

## **1.7 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.

## **1.8 FIELD CONDITIONS**

- A. Maintain uniform temperature of minimum 60 degrees F, and maximum humidity of 40 percent prior to, during, and after acoustical unit installation.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Acoustic Tiles/Panels:
  - 1. Armstrong World Industries, Inc; Fissured 756A: [www.armstrong.com](http://www.armstrong.com) **Basis of Design.**
  - 2. CertainTeed Corporation: [www.certainteed.com](http://www.certainteed.com)
  - 3. USG: [www.usg.com](http://www.usg.com)
- B. Suspension Systems:
  - 1. Same as for acoustical units.

### **2.2 ACOUSTICAL UNITS**

- A. Acoustical Units - General: ASTM E1264, Class A.
  - 1. VOC Content: Certified as Low Emission by one of the following:
    - a. Product listing in UL (GGG).

### **2.3 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.
- B. Wire Hangers, Braces, and Ties: Provide wires complying with the following requirements:
  - 1. Zinc-coated carbon-steel wire: ASTM A 641/A 641M,, Class 1 zinc coating, soft temper.
  - 2. Size: Select wire diameter so its stress at three times hanger design load (ASTM C 635, Table 1, "Direct Hung") will be less than yield stress of wire, but provide not less than 0.106-inch diameter wire.

## **2.4 ACCESSORIES**

- A. Support Channels and Hangers: Galvanized steel; size and type to suit application and ceiling system flatness requirement specified.
- B. Hanger Wire: 12 gauge, 0.08 inch galvanized steel wire.
- C. Perimeter Moldings: Same metal and finish as grid.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify that layout of hangers will not interfere with other work.

### **3.2 INSTALLATION - SUSPENSION SYSTEM**

- A. Install suspension system in accordance with ASTM C636/C636M 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. Locate system on room axis according to reflected plan.
- D. Perimeter Molding: Install at intersection of ceiling and vertical surfaces and at junctions with other interruptions.
  - 1. Use longest practical lengths.
- E. 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.
- F. 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.
- G. Do not support components on main runners or cross runners if weight causes total dead load to exceed deflection capability.
- H. Support fixture loads using supplementary hangers located within 6 inches of each corner, or support components independently.
- I. Do not eccentrically load system or induce rotation of runners.

### **3.3 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. Cut to fit irregular grid and perimeter edge trim.

- 2. Make field cut edges of same profile as factory edges.
- F. Where round obstructions occur, provide preformed closures to match perimeter molding.
- G. Install hold-down clips on panels within 20 ft of an exterior door.

### **3.4 TOLERANCES**

- A. Maximum Variation from Flat and Level Surface: 1/8 inch in 10 feet.
- B. Maximum Variation from Plumb of Grid Members Caused by Eccentric Loads: 2 degrees.

**END OF SECTION 09 51 00**

**SECTION 09 65 00**

**RESILIENT FLOORING**

**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 SECTION INCLUDES**

- A. Resilient tile flooring.
- B. Resilient base.
- C. Installation accessories.

**1.3 RELATED REQUIREMENTS**

- A. Section 01 61 16 - (VOC) Content Restrictions.
- B. Section 03 30 00 - Cast-in-Place Concrete: Restrictions on curing compounds for concrete slabs and floors to receive adhesive-applied resilient flooring.
- C. Section 09 05 61 - Common Work Results for Flooring Preparation: Removal of existing floor coverings, cleaning, and preparation.

**1.4 REFERENCE STANDARDS**

- A. ASTM F1066 - Standard Specification for Vinyl Composition Floor Tile; 2004 (Reapproved 2018).
- B. ASTM F1861 - Standard Specification for Resilient Wall Base; 2016.
- C. RFCI (RWP) - Recommended Work Practices for Removal of Resilient Floor Coverings; 2011.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - 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. Shop Drawings: Indicate seaming plans and floor patterns.
- D. Selection Samples: Submit manufacturer's complete set of color samples for Architect's initial selection.
- E. Verification Samples: Submit two samples, 12 by 12 inch in size illustrating color and pattern for each resilient flooring product specified.
- F. Concrete Subfloor Test Report: Submit a copy of the moisture and alkalinity (pH) test reports.
- G. Certification: Prior to installation of flooring, submit written certification by flooring manufacturer and adhesive manufacturer that condition of subfloor is acceptable.
- H. Maintenance Data: Include maintenance procedures, recommended maintenance materials, and suggested schedule for cleaning, stripping, and re-waxing.

I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.

1. See Section 01 60 00 - Product Requirements, for additional provisions.
2. Extra Flooring Material: 25 square feet of each type and color.
3. Extra Wall Base: 25 linear feet of each type and color.

**1.6 QUALITY ASSURANCE**

- A. Installer Qualifications: Company specializing in installing specified flooring with minimum three years documented experience.
- B. Testing Agency Qualifications: Independent firm specializing in performing concrete slab moisture testing and inspections of the type specified in this section.

**1.7 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.
- C. Maintain temperature in storage area between 55 degrees F and 90 degrees F.
- D. Do not double stack pallets.

**1.8 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 to achieve temperature stability. Thereafter, maintain conditions above 55 degrees F.

**PART 2 PRODUCTS**

**2.1 TILE FLOORING**

- A. Vinyl Composition Tile: Homogeneous, with color extending throughout thickness.
  1. Manufacturers:
    - a. Armstrong Flooring, Inc; Match existing: [www.armstrongflooring.com](http://www.armstrongflooring.com).
  2. Minimum Requirements: Comply with ASTM F1066, of Class corresponding to type specified.
  3. Size: 12 by 12 inch.
  4. Thickness: 0.125 inch.

**2.2 RESILIENT BASE**

- A. Resilient Base: ASTM F1861, Type TS rubber, vulcanized thermoset; top set Style B, Cove.
  1. Manufacturers:
    - a. Burke Flooring; Commercial Wall Base - TS: [www.burkeflooring.com](http://www.burkeflooring.com).
    - b. Johnsonite, a Tarkett Company: [www.johnsonite.com](http://www.johnsonite.com).

- c. Roppe Corp: [www.roppe.com](http://www.roppe.com).
- d. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Height: 4 inch.
- 3. Thickness: 0.125 inch.
- 4. Finish: Satin.
- 5. Length: Roll.
- 6. Color: To be selected by Architect from manufacturer's full range.
- 7. Accessories: Premolded external corners and internal corners.

## **2.3 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.
  - 1. VOC Content Limits: As specified in Section 01 61 16.
- C. Adhesive for Vinyl Flooring:
  - 1. Manufacturers:
    - a. Stauf USA, LLC; D737 High-Tack: [www.staufusa.com](http://www.staufusa.com).
    - b. Substitutions: Section 01 60 00 - Product Requirements.
- D. Moldings, Transition and Edge Strips: Same material as flooring.
  - 1. Manufacturers:
    - a. Burke Flooring; Mercer Vinyl Mouldings: [www.burkeflooring.com](http://www.burkeflooring.com).
    - b. Substitutions: See Section 01 60 00 - Product Requirements.

## **PART 3 EXECUTION**

### **3.1 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.
- B. Cementitious Subfloor Surfaces: Verify that substrates are ready for resilient flooring installation by testing for moisture and alkalinity (pH).
  - 1. Test in accordance with Section 09 05 61.
  - 2. Obtain instructions if test results are not within limits recommended by resilient flooring manufacturer and adhesive materials manufacturer.
- C. Verify that required floor-mounted utilities are in correct location.

### **3.2 PREPARATION**

- A. Remove existing resilient flooring and flooring adhesives; follow the recommendations of RFCI (RWP).
- B. Remove subfloor ridges and bumps. Fill minor low spots, cracks, joints, holes, and other defects with subfloor filler to achieve smooth, flat, hard surface.
- C. Prohibit traffic until filler is fully cured.

### **3.3 INSTALLATION - GENERAL**

- A. Starting installation constitutes acceptance of subfloor conditions.
- B. Install in accordance with manufacturer's written instructions.

### **3.4 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.
- B. Install plank tile with a random offset of at least 6 inches from adjacent rows.

### **3.5 INSTALLATION - RESILIENT BASE**

- A. Fit joints tightly and make vertical. Maintain minimum dimension of 18 inches between joints.
- B. Miter internal corners. At external corners, use premolded units. At exposed ends, use premolded units.
- C. Install base on solid backing. Bond tightly to wall and floor surfaces.
- D. Scribe and fit to door frames and other interruptions.

### **3.6 CLEANING**

- A. Remove excess adhesive from floor, base, and wall surfaces without damage.
- B. Clean in accordance with manufacturer's written instructions.

### **3.7 PROTECTION**

- A. Prohibit traffic on resilient flooring for 48 hours after installation.

**END OF SECTION 09 65 00**



SECTION 09 65 67

RESILIENT MODULAR ATHLETIC FLOORING

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Athletic tile rubber flooring.
- B. Related Sections:
  - 1. Section 03 30 00 - Cast-In-Place Concrete.
  - 2. Section 09 65 00 - Resilient Flooring; rubber base.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit copies of each of the following:
  - 1. Manufacturer's standard product data.
  - 2. Manufacturer's requirements for correct preparation, finishing and testing of substrate base material to receive pre-manufactured rubber sport surface.
  - 3. Adhesive product data sheets and manufacturer's certificates indicating approval for the proposed application.
  - 4. Manufacturer's standard warranty.
  - 5. Manufacturer's installation and maintenance instructions.
- C. Shop Drawings: Include appropriate room bordering or feature strip details.
- D. Samples: Provide samples of the actual sport surface, feature and reducer strips, in standard colors. Architect reserves the right to reject any brand of flooring on the basis of color at no extra cost to the Owner.

1.3 QUALITY ASSURANCE

- A. Acceptable manufacturer:
  - 1. The manufacturer to be a firm experienced in the manufacturing of prefabricated rubber surface.
- B. Acceptable Installer:
  - 1. Installer must submit a list of similar projects completed within the past three years.
  - 2. Installer to be recognized and approved by the sport surfacing manufacturer.

1.4 DELIVERY AND STORAGE

- A. Deliver and store material in the original containers with seals unbroken and labels intact, in a maintained environment of a minimum of 55° F. and under 55% relative humidity. Protect work until accepted by Owner.

1.5 PROJECT CONDITIONS

- A. Temperatures: A temperature of at least 70° F. shall be maintained in the surrounding area and on the surface receiving the floor covering for 24 hours prior to beginning work, during installation, and for 48 hours after installation is completed.

1.6 WARRANTY

- A. Submit manufacturer's standard 3-year warranty against defects in material and workmanship.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Rubber Athletic Tile Flooring (RU): Provide Recoil Fitness Flooring as manufactured by Roppe Corporation or equivalent product by one of the following:
  - 1. Tarkett
  - 2. Flexco
  - 3. Regupol
- B. Resilient rubber flooring consisting of vulcanized post-consumer recycled tire material from commercial and automobile tire compositions mixed with vulcanized post-industrial recycled and colored rubber EPDM (Ethylene-Propylene Diene Monomer) chips which are then encapsulated in a premium urethane binder.
  - 1. Interlocking Tile: ASTM F3041 - Bonded Crumb Rubber: Type I & II, Class A,B,C & D
  - 2. Size: Nominal 34-1/4 inch square.
  - 3. Thickness: 3/8 inch.
  - 4. Color(s) shall be as selected by Architect from manufacturer's complete color line.
- C. Adhesive for the application of resilient rubber flooring shall be as recommended by rubber floor manufacturer.
- D. Edge strips (Reducer Strip) shall be TRS-11. Color as selected by Architect.
- E. Floor filler/resurfacing material shall be as recommended by rubber floor manufacturer.

## PART 3 - EXECUTION

### 3.1 INSPECTION

- A. Carefully and completely examine area to receive rubber flooring and accessories for conditions that will adversely affect the execution and quality of work. Do not start this work until unsatisfactory conditions are corrected.

### 3.2 PREPARATION

- A. All other trades shall be completely finished in this area.
- B. Preparation of substrate to provide a smooth, dense finish highly compacted with a tolerance of 1/8" in a 10' radius.
- C. Concrete substrate to be in place a minimum of thirty days prior to the installation of the rubber athletic flooring.
- D. All inserts, penetrations and other construction items which affect the installation of the prefabricated rubber sport surface to be in place.
- E. Preparation of Sub-floors: All oil, grease, paint, dried mortar residue and other materials shall be removed by scraping, sanding or scrubbing. Surfaces shall be swept clean of dust and dirt. Where detergents are used, surfaces shall be rinsed thoroughly and sufficient time allowed for complete drying. New concrete sub-floors must be thoroughly cured before flooring is installed. If sub-floors are considered to be unusually smooth, an application of 50% commercial grade muriatic acid and water shall be used to etch the surface to ensure a permanent bond. Acid shall be removed after effervescence ceases and surface rinsed with clear water and allowed to dry. All cracks, expansion joints, rough and irregular or damaged portions of the floor shall be filled with the floor fill underlayment material. Moisture tests shall be made on all new concrete surfaces.

### 3.3 INSTALLATION

- A. Application of Adhesive:
  - 1. Adhesive shall be applied in strict accordance with manufacturer's directions. Adhesive shall be applied with a notched trowel and in amounts not less than those recommended on labels and published instructions. Notches in the trowel shall be: depth 1/8", open area 1/8", flat area 1/16", and care

shall be taken to maintain full depth during the entire installation. An approved trowel is Gunlach model FOW.

2. It is essential that the tile be applied promptly as the adhesive sets rapidly by chemical reaction. It is recommended that not more than one unit of adhesive be spread, then tile be laid promptly (approximately 80-90 sq. ft.).
- B. Application of Flooring: Tile for each space shall be taken from several containers and distributed evenly into one group to reduce the variation in pattern. Tile shall be laid so as to ensure good contact with close, even joints in true and continuous alignment; it shall be carefully scribed to form a tight and neat joint with vertical surfaces. Tile shall be rolled immediately after installation with a 75-lb. sectional roller. Excessive adhesive shall be cleared from tile, while still wet, with a cloth dampened in denatured alcohol.
- C. Edging Strips: Use edge strips where tile stops and the edge is exposed.

#### 3.4 CLEANING

- A. Remove foreign matter from tile flooring and base. Clean floor with cleaner in conformance with manufacturer's instructions. Replace defective or damaged material at no additional cost to the Owner.
- B. Remove from the premises all debris caused by work under this Section.

#### 3.5 PROTECTION

- A. All traffic shall be prohibited for a period of 12 hours after installation, then limited traffic for an additional 12 hours.

END OF SECTION

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**SECTION 09 67 23**

**RESINOUS FLOORING**

**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: Decorative urethane cement composition flooring and integral base.
- B. Related Work
  - 1. Section 03 30 00 – Cast-In-Place Concrete.
  - 2. Division 22 – Plumbing: Floor drains.

**1.3 SUBMITTALS**

- A. General: Submit the following in accordance with SECTION 01 33 23 – SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES.
- B. Product Data: Submit manufacturer's technical data, application instructions and general recommendations for the urethane cement composition flooring specified herein.
- C. Samples for initial selection purposes in form of sample of red, gray or natural pigmented Tek-Crete
  - 1. Submit 2 1/2" x 4" samples in color selection as designated by the Architect.
- D. Samples for Verification: Submit sample of each resinous flooring system required, 6 inches square, applied by Installer for this Project to a rigid backing, in color, texture, and finish indicated. Where finishes involve normal color and texture variations, include Sample sets showing the full range of variations expected.
- E. Material certificates signed by manufacturer certifying that the urethane cement composition flooring supplied for the project complies with requirements specified herein.
- F. Maintenance Instructions: Submit manufacturer's written instructions for recommended maintenance practices.
- G. Contractor Certification: Submit a letter from the primary materials manufacturer certifying that the installing contractor has been properly trained in the application of the materials being installed, is acceptable to the materials manufacturer, with a record of successful in-service performance.
  - 1. Engage an installer who employs only persons trained and approved by the resinous flooring manufacturer for applying resinous flooring systems specified.
  - 2. Engage an installer who is certified in writing by the resinous flooring manufacturer as a factory trained applicator qualified to apply the specified resinous flooring system.

**1.4 QUALITY ASSURANCE**

- A. Installer Qualifications: Engage an experienced installer (applicator) who has specialized in installing resinous flooring similar in material, design, and extent to that indicated for this Project and who is acceptable to resinous flooring manufacturer. Engage an installer who is certified in writing by resinous flooring manufacturer as qualified to install resinous flooring systems specified.

- B. Source Limitations: Obtain primary resinous flooring materials, including primers, resins, hardening agents, and sealing or finish coats, through one source from a single manufacturer. Provide secondary materials including patching and fill material, joint sealant, and repair materials of type and from source recommended by manufacturer of primary materials.
- C. Field Samples: On floor area selected by Architect, provide full-thickness resinous flooring system samples that are at least 48 inches square to demonstrate texture, color, thickness, chemical resistance, cleanability, and other features of each resinous flooring system required. Simulate finished lighting conditions for review of in-place field samples.
  - 1. If field samples are unacceptable, make adjustments to comply with requirements and apply additional samples until field samples are approved.
  - 2. After field samples are approved, these surfaces will be used to evaluate resinous flooring.
  - 3. Obtain Architect's approval of field samples before applying resinous flooring.

## 1.5 DELIVERY, STORAGE, AND HANDLING

- A. Deliver materials in original packages and containers with seals unbroken and bearing manufacturer's labels containing brand name and directions for storage and mixing with other components.
- B. Store materials to comply with manufacturer's directions to prevent deterioration from moisture, heat, cold, direct sunlight, or other detrimental effects.

## 1.6 PROJECT CONDITIONS

- A. Environmental Conditions: Comply with urethane cement composition flooring manufacturer's directions for maintenance of ambient and substrate temperature, moisture, humidity, ventilation, and other conditions required to execute and protect Work.
- B. Lighting: Permanent lighting will be in place and working before installing resinous flooring.
- C. Moisture Vapor Transmission: Perform Calcium Chloride test in conformance to ASTM F1869 or In Situ relative humidity test conforming to ASTM F2170 to determine moisture vapor emission levels prior to application of any component of the flooring system. Do not install flooring over substrate with MVT emission levels in excess of 14 lbs. per 24 hour period over a 1000 square foot area or with a relative humidity in excess of 88%. Notify the architect immediately if MVT or RH levels exceed these levels.

## PART 2 - PRODUCTS

### 2.1 MATERIALS/MANUFACTURERS

- A. Troweled urethane cement composition flooring shall be **Dex-O-Tex Tek-Crete SL-CQ** as manufactured by Crossfield Products Corp. in Rancho Dominguez, California and Roselle Park, New Jersey. Equivalent products from the following manufacturers will be acceptable:
  - 1. Dur-A-Flex, Inc. (phone 800.253.3539 web site: [www.dur-a-flex.com](http://www.dur-a-flex.com))
  - 2. General Polymers, Inc., Div. of Sherwin-William (phone 800.543.7694 web site: [www.generalpolymers.com](http://www.generalpolymers.com))  
Key Resin Company (phone 888.943.4532 web site: [www.keyresin.com](http://www.keyresin.com))
  - 3. Stonhard (phone 800.257.7953 web site: [www.stonhard.com](http://www.stonhard.com))

### 2.2 PROPERTIES

- A. Colors: As selected by Architect from manufacturer's standard colors.

**B. Physical Properties:**

Provide flooring system that meet or exceed the listed minimum physical property requirements when tested according to the referenced standard test method in parentheses.

Compressive Strength (ASTM C579)	8100 PSI
Thermal Distortion (250OF Emersion)	Passes
Tensile Strength (ASTM C307)	1,000 psi
Flexural Strength (ASTM C580)	2,000 psi
Thermal Co-Efficient of Thermal Expansion (ASTM C531)	1.4x105 Densit (ASTM C580)
Density (ASTM C905)	130 lbs.ft#
Water Absorption (MIL PRF 3134)	0.64%
Surface Hardness (ASTM D2240)	85- 90 Durometer "D"
Abrasion Resistance (ASTM D1044)	0.0 gr.
Adhesion (ASTM D4541)	>400 psi (100% failure in concrete)
Flammability Critical Radiant Flux (ASTM E648)	Greater than 1.07 watts/cm2
Resistance to Fungal Growth (ASTM G21)	Passes Rating 1

**PART 3 - EXECUTION**

**3.1 INSPECTION**

- A. Examine the areas and conditions where the urethane cement composition flooring is to be installed and notify the Architect of conditions detrimental to the proper and timely completion of the work. Do not proceed with the work until unsatisfactory conditions have been corrected by the Contractor in a manner acceptable to the Architect.
- B. Moisture Test: Perform moisture test in conformance with ASTM F 1869 and ASTM F 2170

**3.2 PREPARATION**

- A. Substrate: Perform preparation and cleaning procedures according to flooring manufacturer's instructions for particular substrate conditions involved, and as specified. Provide clean, dry, and neutral substrate for flooring application.
- B. Concrete Surfaces: Shot blast, or power scarify as required to obtain optimum bond of flooring to concrete. Remove sufficient material to provide a sound surface free of laitance, glaze, efflorescence, and any bond inhibiting curing compounds or form release agents. Remove grease, oil, and other penetrating contaminate. Prepare substrate in accordance with SSPC SP 13. Repair damaged and deteriorated concrete to acceptable condition. Leave surface free of dust, dirt, laitance, and efflorescence.
- C. Materials: Mix resin hardener and aggregate as required, and prepare materials according to flooring system manufacturer's instructions.

**3.3 APPLICATION**

- A. General: Apply each component of urethane cement composition flooring system according to manufacturer's directions to produce a uniform monolithic flooring surface of thickness indicated.
- B. Body Coat: Over prepared surface, Screed mortar mix at nominal 3/16" – 1/4" inch thickness as specified. Allow material flow out and begin to settle. Back roll with a spike roller or looped roller as appropriate to distribute material to a smooth even finish.
- C. Broadcast Aggregate: Broadcast selected colored quartz aggregate blend into the wet Body Coat. Apply to an even distribution and texture, allow to cure.

- D. Remove Excess Aggregate: Remove all loose or unsound colored quartz aggregate from the cured surface. Vacuum up all dust and fine particles from the surface, remove any ridge lines and detail all imperfection in the textured surface.
- E. Apply the selected clear seal coats as recommended to produce a surface matching the submittal sample and project mock-up samples.
- F. Cove Base: Apply cove base mix to wall surfaces at locations shown to form cove base height of 4 inches unless otherwise indicated. Follow manufacturer's printed instructions and details including taping, mixing, troweling, and sanding, of cove base.

### **3.4 FIELD QUALITY CONTROL**

- A. Material Sampling: Owner may at any time and any number of times during flooring application require material samples for testing for compliance with requirements.
  - 1. Owner will engage an independent testing agency to take samples of materials being used. Material samples will be taken, identified and sealed, and certified in presence of Contractor.
  - 2. Testing agency will test samples for compliance with requirements, using applicable referenced testing procedures or, if not referenced, using testing procedures listed in manufacturer's Product Data.
  - 3. If test results show installed materials do not comply with specified requirements, pay for testing, remove noncomplying materials, prepare surfaces coated with unacceptable materials, and reapply flooring materials to comply with requirements.

### **3.5 CURING, PROTECTION AND CLEANING**

- A. Cure urethane cement composition flooring materials according to manufacturer's directions, taking care to prevent contamination during application stages and before completing curing process. Close application area for a minimum of 24 hours.
- B. Protect resinous flooring from damage and wear during the remainder of construction period. Use protective methods and materials, including temporary covering, recommended in writing by resinous flooring manufacturer.
- C. Clean resinous flooring not more than 4 days before dates scheduled for inspections intended to establish date of substantial completion in each project area. Use cleaning materials and procedures recommended in writing by resinous flooring manufacturer.

**END OF SECTION 09 67 23**



**SECTION 09 91 23**

**INTERIOR PAINTING**

**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 SECTION INCLUDES**

- A. Surface preparation.
- B. Field application of paints, stains, and varnishes.
- C. Scope: Finish interior surfaces exposed to view, unless fully factory-finished and unless otherwise indicated.
  - 1. Both sides and edges of plywood backboards for electrical and telecom equipment before installing equipment.
  - 2. Prime surfaces to receive wall coverings.
  - 3. Mechanical and Electrical:
    - a. In finished areas, paint insulated and exposed pipes, conduit, boxes, insulated and exposed ducts, hangers, brackets, collars and supports, mechanical equipment, and electrical equipment, unless otherwise indicated.
    - b. In finished areas, paint shop-primed items.
    - c. Paint interior surfaces of air ducts that are visible through grilles and louvers with one coat of flat black paint to visible surfaces.
    - d. Paint dampers exposed behind louvers, grilles, to match face panels.
- D. Do Not Paint or Finish the Following Items:
  - 1. Items factory-finished unless otherwise indicated; materials and products having factory-applied primers are not considered factory finished.
  - 2. Items indicated to receive other finishes.
  - 3. Items indicated to remain unfinished.
  - 4. Fire rating labels, equipment serial number and capacity labels, bar code labels, and operating parts of equipment.
  - 5. Stainless steel, anodized aluminum, bronze, terne coated stainless steel, and lead items.
  - 6. Marble, granite, slate, and other natural stones.
  - 7. Floors, unless specifically indicated.
  - 8. Ceramic and other tiles.
  - 9. Brick, architectural concrete, cast stone, integrally colored plaster and stucco.

10. Glass.
11. Concrete masonry units in utility, mechanical, and electrical spaces.
12. Acoustical materials, unless specifically indicated.
13. Concealed pipes, ducts, and conduits.

### **1.3 RELATED REQUIREMENTS**

- A. Section 05 50 00 - Metal Fabrications: Shop-primed items.
- B. Section 09 91 13 - Exterior Painting.
- C. Section 09 99 00 - Color Schedule: Finish colors.

### **1.4 DEFINITIONS**

- A. Comply with ASTM D16 for interpretation of terms used in this section.

### **1.5 REFERENCE STANDARDS**

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D16 - Standard Terminology for Paint, Related Coatings, Materials, and Applications; 2016.
- C. ASTM D4258 - Standard Practice for Surface Cleaning Concrete for Coating; 2005 (Reapproved 2017).
- D. ASTM D4442 - Standard Test Methods for Direct Moisture Content Measurement of Wood and Wood-Based Materials; 2020.
- E. MPI (APL) - Master Painters Institute Approved Products List; Master Painters and Decorators Association; Current Edition.
- F. MPI (APSM) - Master Painters Institute Architectural Painting Specification Manual; Current Edition.
- G. SSPC-SP 1 - Solvent Cleaning; 2015, with Editorial Revision (2016).
- H. SSPC-SP 6 - Commercial Blast Cleaning; 2007.
- I. SSPC-SP 13 - Surface Preparation of Concrete; 1997 (Reaffirmed 2003).

### **1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide complete list of products to be used, with the following information for each:
  1. Manufacturer's name, product name and/or catalog number, and general product category (e.g. "alkyd enamel").
  2. MPI product number (e.g. MPI #47).
  3. Cross-reference to specified paint system(s) product is to be used in; include description of each system.
  4. Manufacturer's installation instructions.

5. If proposal of substitutions is allowed under submittal procedures, explanation of substitutions proposed.
- C. Samples: Submit three paper "draw down" samples, 4 x 4 inches in size, illustrating range of colors available for each finishing product specified.
1. Where sheen is specified, submit samples in only that sheen.
  2. Where sheen is not specified, discuss sheen options with Architect before preparing samples, to eliminate sheens definitely not required.
  3. Allow 30 days for approval process, after receipt of complete samples by Architect.
  4. Paint color submittals will not be considered until color submittals for major materials not to be painted, such as masonry, factory finished metals, wood cabinets, and wood doors, have been approved.
- D. Certification: By manufacturer that paints and finishes comply with VOC limits specified.
- E. Manufacturer's Instructions: Indicate special surface preparation procedures and substrate conditions requiring special attention.
- F. Maintenance Data: Submit data including finish schedule showing where each product/color/finish was used, product technical data sheets, material safety data sheets (MSDS), care and cleaning instructions, touch-up procedures, repair of painted and finished surfaces, and color samples of each color and finish used.
- G. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
1. See Section 01 60 00 - Product Requirements, for additional provisions.
  2. Extra Paint and Finish Materials: 1 gallon of each color, type, and surface texture; from the same product run, store where directed.
  3. Label each container with color, type, texture, and room locations in addition to the manufacturer's label.

## **1.7 QUALITY ASSURANCE**

- A. Applicator Qualifications: Company specializing in performing the type of work specified with minimum 3 years experience and approved by manufacturer.

## **1.8 MOCK-UP**

- A. See Section 01 40 00 - Quality Requirements, for general requirements for mock-up.
- B. Provide panel, 10 feet long by 10 feet wide, illustrating paint color, texture, and finish.
- C. Provide door and frame assembly illustrating paint color, texture, and finish.
- D. Locate where directed by Architect.
- E. Mock-up may remain as part of the work, if approved by Architect.
- F. Apply mockups of each paint system indicated and each color and finish selected to verify preliminary selections made under Sample submittals and to demonstrate aesthetic effects and set quality standards for materials and execution.
1. Architect will select one surface to represent surfaces and conditions for application of each paint system.
    - a. Vertical and Horizontal Surfaces: Provide samples of at least 100 sq. ft.

- b. Other Items: Architect will designate items or areas required.
- 2. Final approval of color selections will be based on mockups.
  - a. If preliminary color selections are not approved, apply additional mockups of additional colors selected by Architect at no added cost to Owner.
- 3. Approval of mockups does not constitute approval of deviations from the Contract Documents contained in mockups unless Architect specifically approves such deviations in writing.
- 4. Subject to compliance with requirements, approved mockups may become part of the completed Work if undisturbed at time of Substantial Completion.

## **1.9 DELIVERY, STORAGE, AND HANDLING**

- A. Deliver products to site in sealed and labeled containers; inspect to verify acceptability.
- B. Container Label: Include manufacturer's name, type of paint, brand name, lot number, brand code, coverage, surface preparation, drying time, cleanup requirements, color designation, and instructions for mixing and reducing.
- C. Paint Materials: Store at minimum ambient temperature of 45 degrees F and a maximum of 90 degrees F, in ventilated area, and as required by manufacturer's instructions.

## **1.10 FIELD CONDITIONS**

- A. Do not apply materials when surface and ambient temperatures are outside the temperature ranges required by the paint product manufacturer.
- B. Follow manufacturer's recommended procedures for producing best results, including testing of substrates, moisture in substrates, and humidity and temperature limitations.
- C. Do not apply materials when relative humidity exceeds 85 percent; at temperatures less than 5 degrees F above the dew point; or to damp or wet surfaces.
- D. Minimum Application Temperatures for Paints: 50 degrees F for interiors unless required otherwise by manufacturer's instructions.
- E. Provide lighting level of 80 ft candles measured mid-height at substrate surface.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Provide paints and finishes from the same manufacturer to the greatest extent possible.
  - 1. In the event that a single manufacturer cannot provide specified products, minor exceptions will be permitted provided approval by Architect is obtained using the specified procedures for substitutions.
  - 2. Substitution of MPI-approved products by a different manufacturer is preferred over substitution of unapproved products by the same manufacturer.
  - 3. Substitution of a different paint system using MPI-approved products by the same manufacturer will be considered.
- B. Paints:
  - 1. Sherwin-Williams Company: [www.sherwin-williams.com](http://www.sherwin-williams.com).

- C. Primer Sealers: Same manufacturer as top coats.
- D. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.2 PAINTS AND FINISHES - GENERAL**

- A. Paints and Finishes: Ready mixed, unless intended to be a field-catalyzed paint.
  - 1. Where MPI paint numbers are specified, provide products listed in Master Painters Institute Approved Product List, current edition available at [www.paintinfo.com](http://www.paintinfo.com), for specified MPI categories, except as otherwise indicated.
  - 2. Provide paints and finishes of a soft paste consistency, 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.
  - 3. Provide materials that are compatible with one another and the substrates indicated under conditions of service and application, as demonstrated by manufacturer based on testing and field experience.
  - 4. For opaque finishes, tint each coat including primer coat and intermediate coats, one-half shade lighter than succeeding coat, with final finish coat as base color.
  - 5. Supply each paint material in quantity required to complete entire project's work from a single production run.
  - 6. Do not reduce, thin, or dilute paint or finishes or add materials unless such procedure is specifically described in manufacturer's product instructions.
- B. Volatile Organic Compound (VOC) Content:
  - 1. Provide paints and finishes that comply with the most stringent requirements specified in the following:
    - a. 40 CFR 59, Subpart D--National Volatile Organic Compound Emission Standards for Architectural Coatings.
    - b. Ozone Transport Commission (OTC) Model Rule, Architectural, Industrial, and Maintenance Coatings; [www.otcair.org](http://www.otcair.org); specifically:
      - 1) Opaque, Flat: 50 g/L, maximum.
      - 2) Opaque, Nonflat: 150 g/L, maximum.
      - 3) Opaque, High Gloss: 250 g/L, maximum.
    - c. Architectural coatings VOC limits of the State in which the Project is located.
  - 2. Determination of VOC Content: Testing and calculation in accordance with 40 CFR 59, Subpart D (EPA Method 24), exclusive of colorants added to a tint base and water added at project site; or other method acceptable to authorities having jurisdiction.
- C. Sheens: Provide the sheens specified; where sheen is not specified, sheen will be selected later by Architect from the manufacturer's full line.
- D. Colors: As indicated on drawings.
  - 1. Allow for minimum of three colors for each system, unless otherwise indicated, without additional cost to Owner.
  - 2. Extend colors to surface edges; colors may change at any edge as directed by Architect.

3. In finished areas, finish pipes, ducts, conduit, and equipment the same color as the wall/ceiling they are mounted on/under.
4. In utility areas, finish equipment, piping, conduit, and exposed duct work in colors according to the color coding scheme indicated.

## 2.3 PAINT SYSTEMS - INTERIOR

- A. Interior Surfaces to be Painted, Unless Otherwise Indicated: Including gypsum board, concrete, concrete masonry units, wood, plaster, uncoated steel, shop primed steel, and galvanized steel.
  1. Two top coats and one coat primer.
  2. Top Coat(s): Institutional Low Odor/VOC Interior Latex; MPI #143, 144, 145, 146, 147, or 148.
    - a. Products:
      - 1) Sherwin-Williams Harmony Interior Acrylic Latex, Eg-Shel. (MPI #144)
      - 2) Substitutions: Not permitted.
  3. Top Coat Sheen:
    - a. Flat: MPI gloss level 1; use this sheen See Section 09 99 00.
    - b. Velvet: MPI gloss level 2; use this sheen See Section 09 99 00.
    - c. Eggshell: MPI gloss level 3; use this sheen See Section 09 99 00.
    - d. Satin: MPI gloss level 4; use this sheen See Section 09 99 00.
    - e. Semi-Gloss: MPI gloss level 5; use this sheen See Section 09 99 00.
    - f. Gloss: MPI gloss level 6; use this sheen See Section 09 99 00.
  4. Primer: As recommended by top coat manufacturer for specific substrate.
- B. Medium Duty Door/Trim: For surfaces subject to frequent contact by occupants, including metals and wood:
  1. Medium duty applications include doors, door frames, railings, handrails, guardrails, and balustrades.
  2. Two top coats and one coat primer.
  3. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
    - a. Products:
      - 1) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.
      - 2) Substitutions: Not permitted.
- C. Medium Duty Vertical and Overhead: Including gypsum board, plaster, concrete, concrete masonry units, uncoated steel, shop primed steel, galvanized steel, and CMU as indicated for epoxy finish.
  1. Two top coats and one coat primer.
  2. Top Coat(s): Interior Epoxy-Modified Latex; MPI #115 or 215.
    - a. Products:
      - 1) Sherwin-Williams Waterbased Catalyzed Epoxy, Semi-Gloss.

2) Substitutions: Not permitted.

D. Dry Fall: Metals; exposed structure and overhead-mounted services in utilitarian spaces, including shop primed steel deck, structural steel, metal fabrications, galvanized ducts, galvanized conduit, and galvanized piping.

1. Shop primer by others.

2. One top coat.

3. Top Coat: Latex Dry Fall.

a. Products:

1) Sherwin-Williams Waterborne Acrylic Dryfall, Flat. (MPI #118)

2) Sherwin-Williams Waterborne Acrylic Dryfall, Eg-Shel. (MPI #155, 226)

E. Transparent Finish on Concrete Floors.

1. 2 coats sealer.

2. Sealer: Water Based Sealer for Concrete Floors; MPI #99.

a. Products:

1) Sherwin Williams.

## **2.4 PRIMERS**

A. Primers: Provide the following unless other primer is required or recommended by manufacturer of top coats.

## **2.5 ACCESSORY MATERIALS**

A. Accessory Materials: Provide primers, sealers, cleaning agents, cleaning cloths, sanding materials, and clean-up materials as required for final completion of painted surfaces.

B. Patching Material: Latex filler.

C. Fastener Head Cover Material: Latex filler.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

A. Do not begin application of paints and finishes until substrates have been properly prepared.

B. Verify that surfaces are ready to receive work as instructed by the product manufacturer.

C. Examine surfaces scheduled to be finished prior to commencement of work. Report any condition that may potentially effect proper application.

D. If substrate preparation is the responsibility of another installer, notify Architect of unsatisfactory preparation before proceeding.

E. Test shop-applied primer for compatibility with subsequent cover materials.

F. Measure moisture content of surfaces using an electronic moisture meter. Do not apply finishes unless moisture content of surfaces are below the following maximums:

1. Gypsum Wallboard: 12 percent.

2. Plaster and Stucco: 12 percent.
3. Masonry, Concrete, and Concrete Masonry Units: 12 percent.
4. Interior Wood: 15 percent, measured in accordance with ASTM D4442.
5. Concrete Floors and Traffic Surfaces: 8 percent.

### 3.2 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. Remove or repair existing paints or finishes that exhibit surface defects.
- D. Remove or mask surface appurtenances, including electrical plates, hardware, light fixture trim, escutcheons, and fittings, prior to preparing surfaces or finishing.
- E. Seal surfaces that might cause bleed through or staining of topcoat.
- F. Remove mildew from impervious surfaces by scrubbing with solution of tetra-sodium phosphate and bleach. Rinse with clean water and allow surface to dry.
- G. Concrete:
  1. Remove release agents, curing compounds, efflorescence, and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces to be coated exceeds that permitted in manufacturer's written instructions.
  2. Clean surfaces with pressurized water. Use pressure range of 1,500 to 4,000 psi at 6 to 12 inches. Allow to dry.
  3. Clean concrete according to ASTM D4258. Allow to dry.
  4. Prepare surface as recommended by top coat manufacturer and according to SSPC-SP 13.
- H. Masonry:
  1. Remove efflorescence and chalk. Do not coat surfaces if moisture content or alkalinity of surfaces or if alkalinity of mortar joints exceed that permitted in manufacturer's written instructions. Allow to dry.
  2. Prepare surface as recommended by top coat manufacturer.
  3. Clean surfaces with pressurized water. Use pressure range of 600 to 1,500 psi at 6 to 12 inches. Allow to dry.
- I. Concrete Floors and Traffic Surfaces: Remove contamination, acid etch, and rinse floors with clear water. Verify required acid-alkali balance is achieved. Allow to dry.
- J. Gypsum Board: Fill minor defects with filler compound. Spot prime defects after repair.
- K. Plaster: Fill hairline cracks, small holes, and imperfections with latex patching plaster. Make smooth and flush with adjacent surfaces. Wash and neutralize high alkali surfaces.
- L. Galvanized Surfaces:
  1. Remove surface contamination and oils and wash with solvent according to SSPC-SP 1.



M. Ferrous Metal:

1. Solvent clean according to SSPC-SP 1.
2. Shop-Primed Surfaces: Sand and scrape to remove loose primer and rust. Feather edges to make touch-up patches inconspicuous. Clean surfaces with solvent. Prime bare steel surfaces. Re-prime entire shop-primed item.
3. Remove rust, loose mill scale, and other foreign substances using methods recommended in writing by paint manufacturer and blast cleaning according to SSPC-SP 6 "Commercial Blast Cleaning". Protect from corrosion until coated.

N. Wood Surfaces to Receive Opaque Finish: Wipe off dust and grit prior to priming. Seal knots, pitch streaks, and sappy sections with sealer. Fill nail holes and cracks after primer has dried; sand between coats. Back prime concealed surfaces before installation.

O. Wood Doors to be Field-Finished: Seal wood door top and bottom edge surfaces with clear sealer.

P. Metal Doors to be Painted: Prime metal door top and bottom edge surfaces.

### 3.3 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 and recommendations in "MPI Architectural Painting Specification Manual".
- C. Where adjacent sealant is to be painted, do not apply finish coats until sealant is applied.
- D. Do not apply finishes to surfaces that are not dry. Allow applied coats to dry before next coat is applied.
- E. Apply each coat to uniform appearance in thicknesses specified by manufacturer.
- F. Sand wood and metal surfaces lightly between coats to achieve required finish.
- G. Vacuum clean surfaces of loose particles. Use tack cloth to remove dust and particles just prior to applying next coat.
- H. Reinstall electrical cover plates, hardware, light fixture trim, escutcheons, and fittings removed prior to finishing.

### 3.4 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for general requirements for field inspection.
- B. Owner will provide field inspection.

### 3.5 CLEANING

- A. Collect waste material that could constitute a fire hazard, place in closed metal containers, and remove daily from site.

### 3.6 PROTECTION

- A. Protect finishes until completion of project.
- B. Touch-up damaged finishes after Substantial Completion.

**3.7 COLOR SCHEDULE - SEE SECTION 09 99 00.**

**END OF SECTION 09 91 23**

SECTION 10 11 16

MARKERBOARDS AND TACKBOARDS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Framed markerboards and tackboards.
- B. Related Requirements:
  - 1. Section 06 10 00 - Rough Carpentry; wood grounds.

1.2 SUBMITTALS

- A. General: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA, AND SAMPLES
- B. Product Data: Include complete manufacturer's catalog cuts and data sheets of anchors, fasteners, color chips (photographic reproductions are not acceptable) and installation requirements.
- C. Shop Drawings:
  - 1. Include types of units provided, location within each room, and length of each unit.
  - 2. Include dimensioned elevation drawings of each board assembly indicating joint locations and type of joint where required, and board mounting distances from floors.
  - 3. Include cross-section details showing each type of product and components; trim, face, core, backing materials and thickness, and key to elevations.
  - 4. Show anchorage details.
  - 5. Show installation details.
- D. Samples: Submit a 12" x 12" sample of each type of tackboard. Submit a 6" long sample of each component of exposed trim.
- E. Quality Control Submittals:
  - 1. Test Reports: Copies of test reports, from certified testing agency, verifying that products have been tested and meet the specified performance requirements.

1.3 OPERATION AND MAINTENANCE DATA

- A. Submit under provisions of SECTION 01 78 23 - OPERATION AND MAINTENANCE DATA.
- B. Maintenance Data: Include data on regular cleaning, and stain removal.

1.4 REGULATORY REQUIREMENTS

- A. Conform to applicable code for flame/smoke rating for vinyl fabric covered tackboards in accordance with ASTM E 84.

1.5 QUALIFICATIONS

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

1.6 FIELD MEASUREMENTS

- A. Verify that field measurements are as indicated on shop drawings.

1.7 WARRANTY

- A. Assembled Units: Manufacturer's standard 1-year warranty against defects in materials and workmanship.

## PART 2 - PRODUCTS

### 2.1 MATERIALS

- A. Framed Tackboard (TB): Provide vinyl covered tackboards in configuration as shown Product/manufacturer; one of the following:
- Fabricork Vinyl Bulletin Boards; Claridge Products and Equipment, Inc.
  - Vinyl Corkboard; Platinum Visual Systems™; a division of abc School Equipment
1. Heavy-duty, self-healing vinyl machine laminated under high pressure to 1/4" thick cork.
  2. Rigid backing panel of 1/4" hardboard.
  3. Cork and backing panel shall be factory assembled and bonded together.
  4. Colors shall be as selected by Architect.
  5. Tackboards shall be up to 16'-0" in lengths without joints.

### 2.2 FABRICATION

- A. Fabricating Boards: Tackboards shall be factory framed units up to 16'-0" one piece in length. Boards too large to be factory framed shall be assembled on the job to match the factory-built boards.
1. Assemble frames with hairline joints. Corner joints shall be mitered. There shall be no exposed face fasteners of any sort.
  2. Make up boards in single sheets without joints where possible. Where vertical joints are necessary, space them symmetrically and use joint strips to cover them. Horizontal joints are not acceptable.
  3. Manufacturer's labels shall not be exposed to view.

## PART 3 - EXECUTION

### 3.1 EXAMINATION

- A. Verification of Conditions:
1. Verify surfaces to receive units are true and plumb. Report unsuitable conditions to the responsible contractor for correction prior to installation.
  2. Verify moisture and temperature levels of substrate and environment have stabilized.

### 3.2 INSTALLATION

- A. Erecting Framed Units: Install framed tackboards in conformance with the manufacturer's instructions using continuous wall hangers and adjustable mounting clip angles.
1. On masonry walls, secure the hangers with screws into metal expansion shields or with toggle bolts.
  2. On gypsum wallboard partitions, locate the hangers to engage the steel stud flanges where possible and secure with molly bolts or self-drilling fasteners into the studs, or attach to wood blocking with suitable length screws.
  3. Behind the tackboards furnish and field install suitable blocking pads 16" o.c. each way to prevent bowing.
  4. The installed boards shall be flat, plumb, square and rigid.
  5. Mounting Height: From finished floor to bottom of tackboard shall be:  
Junior High / Middle School - 36"

### 3.3 CLEANING

- A. Remove crates, cartons and rubbish from the premises and leave the rooms broom clean. Clean down board surfaces to leave them in perfect condition.

END OF SECTION

**SECTION 10 14 00**

**SIGNAGE**

**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 SECTION INCLUDES**

- A. Room and door signs.

**1.3 REFERENCE STANDARDS**

- A. 36 CFR 1191 - Americans with Disabilities Act (ADA) Accessibility Guidelines for Buildings and Facilities; Architectural Barriers Act (ABA) Accessibility Guidelines; current edition.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

**1.4 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's printed product literature for each type of sign, indicating sign styles, font, foreground and background colors, locations, overall dimensions of each sign.
- C. Signage Schedule: Provide information sufficient to completely define each sign for fabrication, including room number, room name, other text to be applied, sign and letter sizes, fonts, and colors.
  - 1. When room numbers to appear on signs differ from those on drawings, include the drawing room number on schedule.
  - 2. When content of signs is indicated to be determined later, request such information from Owner through Architect at least 2 months prior to start of fabrication; upon request, submit preliminary schedule.
  - 3. Submit for approval by Owner through Architect prior to fabrication.
- D. Samples: Submit two samples of each type of sign, of size similar to that required for project, illustrating sign style, font, and method of attachment.
- E. Manufacturer's Qualification Statement.

**1.5 QUALITY ASSURANCE**

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

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Package signs as required to prevent damage before installation.
- B. Package room and door signs in sequential order of installation, labeled by floor or building.
- C. Store tape adhesive at normal room temperature.

## **1.7 FIELD CONDITIONS**

- A. Do not install tape adhesive when ambient temperature is lower than recommended by manufacturer.
- B. Maintain this minimum temperature during and after installation of signs.

## **PART 2 PRODUCTS**

### **2.1 MANUFACTURERS**

- A. Flat Signs:
  - 1. Best Sign Systems, Inc: [www.bestsigns.com](http://www.bestsigns.com).
  - 2. Cosco Industries (ADA signs); ADA Series 1: [www.coscoarchitecturalsigns.com](http://www.coscoarchitecturalsigns.com).
  - 3. FASTSIGNS: [www.fastsigns.com](http://www.fastsigns.com).
  - 4. Inpro: [www.inprocorp.com](http://www.inprocorp.com).
  - 5. Mohawk Sign Systems, Inc: [www.mohawksign.com](http://www.mohawksign.com).
  - 6. Seton Identification Products: [www.seton.com/aec](http://www.seton.com/aec).
  - 7. Substitutions: See Section 01 60 00 - Product Requirements.

### **2.2 SIGNAGE APPLICATIONS**

- A. Accessibility Compliance: Signs are required to comply with ADA Standards and ICC A117.1 \_\_\_\_\_, unless otherwise indicated; in the event of conflicting requirements, comply with the most comprehensive and specific requirements.
- B. Room and Door Signs: Provide a sign for every doorway, whether it has a door or not, not including corridors, lobbies, and similar open areas.
  - 1. Sign Type: Flat signs with engraved panel media as specified.
  - 2. Provide "tactile" signage, with letters raised minimum 1/32 inch and Grade II braille.
  - 3. Character Height: 1 inch.
  - 4. Sign Height: 2 inches, unless otherwise indicated.
  - 5. Office Doors: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section for replaceable occupant name.
  - 6. Conference and Meeting Rooms: Identify with room numbers to be determined later, not the numbers indicated on drawings; in addition, provide "window" section with sliding "In Use/Vacant" indicator.
  - 7. Service Rooms: Identify with room names and numbers to be determined later, not those indicated on drawings.
  - 8. Rest Rooms: Identify with pictograms, the names "MEN" and "WOMEN", room numbers to be determined later, and braille.

### **2.3 SIGN TYPES**

- A. Flat Signs: Signage media without frame.

1. Edges: Square.
  2. Corners: Square.
  3. Wall Mounting of One-Sided Signs: Tape adhesive.
- B. Color and Font: Unless otherwise indicated:
1. Character Font: Helvetica, Arial, or other sans serif font.
  2. Character Case: Upper case only.
  3. Background Color: Clear.
  4. Character Color: Contrasting color.

## **2.4 TACTILE SIGNAGE MEDIA**

- A. Engraved Panels: Laminated colored plastic; engraved through face to expose core as background color:
1. Total Thickness: 1/8 inch.

## **2.5 ACCESSORIES**

- A. Tape Adhesive: Double sided tape, permanent adhesive.

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify that substrate surfaces are ready to receive work.

### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Install neatly, with horizontal edges level.
- C. Locate signs and mount at heights indicated on drawings and in accordance with ADA Standards and ICC A117.1.
- D. Protect from damage until Date of Substantial Completion; repair or replace damaged items.

**END OF SECTION 10 14 00**

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**SECTION 10 28 00**

**TOILET, BATH, AND LAUNDRY ACCESSORIES**

**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 SECTION INCLUDES**

- A. Commercial toilet accessories.
- B. Grab Bars:
- C. Diaper changing stations.
- D. Utility room accessories.

**1.3 RELATED REQUIREMENTS**

- A. Section 06 10 00 - Rough Carpentry: Concealed supports for accessories, including in wall framing and plates.
- B. Section 14 41 13 - Changing Table Lift.
- C. Section 22 40 00 - Plumbing Fixtures: Under-lavatory pipe and supply covers.

**1.4 REFERENCE STANDARDS**

- A. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- B. ASTM A666 - Standard Specification for Annealed or Cold-Worked Austenitic Stainless Steel Sheet, Strip, Plate, and Flat Bar; 2015.
- C. ASTM C1048 - Standard Specification for Heat-Strengthened and Fully Tempered Flat Glass; 2018.
- D. ASTM C1822 - Standard Specification for Insulating Covers on Accessible Lavatory Piping; 2015.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2020.
- F. ASTM G21 - Standard Practice for Determining Resistance of Synthetic Polymeric Materials to Fungi; 2015.

**1.5 ADMINISTRATIVE REQUIREMENTS**

- A. Coordinate the work with the placement of internal wall reinforcement to receive anchor attachments.

**1.6 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Submit data on accessories describing size, finish, details of function, and attachment methods.
- C. Samples: Submit two samples of each accessory, illustrating color and finish.
- D. Manufacturer's Installation Instructions: Indicate special procedures and conditions requiring special attention.

## **PART 2 PRODUCTS**

### **2.1 COMMERCIAL TOILET ACCESSORIES. REFER TO SCHEDULE ON DRAWINGS.**

- A. Toilet Paper Dispenser: Double roll, surface mounted bracket type, stainless steel, spindleless type for tension spring delivery designed to prevent theft of tissue roll.
  - 1. Attached Purse Shelf: 0.03 inch satin finished stainless steel, with rolled or formed edge at front.
  - 2. Products:
    - a. Bobrick B-2740.
- B. Paper Towel Dispenser: Folded paper type, stainless steel, semi-recessed, with viewing slots on sides as refill indicator and tumbler lock.
  - 1. Products: Owner provided contractor installed.
- C. Soap Dispenser: Liquid soap dispenser, deck-mounted on vanity, with polyethylene container concealed below deck; piston and 4 inch spout of stainless steel with bright polished finish; chrome-plated deck escutcheon.
  - 1. Minimum Capacity: 16 ounces.
  - 2. Products: Owner provided contractor installed.
- D. Mirrors: Stainless steel framed, 1/4 inch thick tempered safety glass; ASTM C1048.
  - 1. Products:
    - a. Bobrick B-290.
- E. Grab Bars: Stainless steel, smooth surface.
  - 1. Standard Duty Grab Bars:
    - a. Push/Pull Point Load: 250 pound-force, minimum.
    - b. Dimensions: 1-1/4 inch outside diameter, minimum 0.05 inch wall thickness, exposed flange mounting, 1-1/2 inch clearance between wall and inside of grab bar.
    - c. Finish: Satin.
    - d. Length and Configuration: As indicated on drawings.
    - e. Products:
      - 1) Bobrick B-6806.
- F. Sanitary Napkin Disposal Unit: Stainless steel, surface-mounted, self-closing door, locking bottom panel with full-length stainless steel piano-type hinge, removable receptacle.
  - 1. Products:
    - a. Bobrick B-270.

## **2.2 COMMERCIAL SHOWER AND BATH ACCESSORIES.**

- A. Shower Curtain Rod: Stainless steel tube, 1 inch outside diameter, 0.04 inch wall thickness, satin-finished, with 3 inch outside diameter, minimum 0.04 inch thick satin-finished stainless steel flanges, for installation with exposed fasteners.
- B. Shower Curtain:
  - 1. Material: Opaque vinyl, 0.008 inch thick, matte finish, with antibacterial treatment, flameproof and stain-resistant.
  - 2. Size: 36 by 72 inches, hemmed edges.
  - 3. Grommets: Stainless steel; pierced through top hem on 6 inch centers.
  - 4. Color: White.
  - 5. Shower Curtain Hooks: Chrome-plated or stainless steel spring wire designed for snap closure.
- C. Folding Shower Seat: Wall-mounted surface; welded tubular seat frame, structural support members, swing-down legs, hinges, and mechanical fasteners of Type 304 stainless steel, L-shaped, right hand seat.
  - 1. Seat: Phenolic or polymeric composite one-piece seat or seat slats, of color as selected.
  - 2. Products:
    - a. Seachrome Corporation; Accessibility Seats- L-Shaped Transfer with Swing-down Legs, Reversible: [www.seachrome.com](http://www.seachrome.com).
    - b. Substitutions: Section 01 60 00 - Product Requirements.

## **2.3 RESIDENTIAL TOILET, SHOWER, AND BATH ACCESSORIES**

- A. Shower Curtain Rod: Straight tube, 1 inch diameter, with mounting flanges for concealed attachment.
  - 1. Material: Stainless steel; bright polished finish.
  - 2. Length: 72 inches.
  - 3. Products:
    - a. Bobrick B-6107.
- B. Shower Curtain: Mildew resistant fabric with corrosion resistant metal grommets.
  - 1. Material: Cotton, machine washable.
  - 2. Color: White.
  - 3. Shower Curtain Hooks: Chrome-plated spring wire.
    - a. Bobrick B-204-1
  - 4. Size: 36 by 72 inches, hemmed edges.
  - 5. Products:
    - a. Bobrick Model 204.

- C. Robe Hook: Single-prong, concealed attachment.

## **2.4 UNDER-LAVATORY PIPE AND SUPPLY COVERS.**

A. Under-Lavatory Pipe and Supply Covers:

1. Insulate exposed drainage piping, including hot, cold, and tempered water supplies under lavatories or sinks to comply with ADA Standards.
2. Exterior Surfaces: Smooth non-absorbent, non-abrasive surfaces.
3. Construction: 1/8 inch flexible PVC.
  - a. Surface Burning Characteristics: Flame spread index of 25 or less and smoke developed index of 450 or less, when tested in accordance with ASTM E84.
  - b. Comply with ASTM C1822, type indicated.
  - c. Microbial and Fungal Resistance: Comply with ASTM G21.
4. Color: White.
5. Fasteners: Reusable, snap-locking fasteners with no sharp or abrasive external surfaces.
6. Products:
  - a. Plumberex Specialty Products, Inc; Plumberex Handy-Shield Maxx: [www.plumberex.com](http://www.plumberex.com).
  - b. Plumberex Specialty Products, Inc; Plumberex Trap Gear: [www.plumberex.com](http://www.plumberex.com).

## **2.5 UTILITY ROOM ACCESSORIES.**

- A. Combination Utility Shelf/Mop and Broom Holder: 0.05 inch thick stainless steel, Type 304, with 1/2 inch returned edges, 0.06 inch steel wall brackets.
1. Drying rod: Stainless steel, 1/4 inch diameter.
  2. Hooks: Two, 0.06 inch stainless steel rag hooks at shelf front.
  3. Mop/broom holders: Three spring-loaded rubber cam holders at shelf front.
  4. Length: 36 inches.
  5. Products:
    - a. Bobrick B-224-36".

## **PART 3 EXECUTION**

### **3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify exact location of accessories for installation.
- C. Verify that field measurements are as indicated on drawings.

- D. See Section 06 10 00 for installation of blocking, reinforcing plates, and concealed anchors in walls and ceilings.

### **3.2 PREPARATION. (BY CONTRACTOR).**

- A. Deliver inserts and rough-in frames to site for timely installation.
- B. Provide templates and rough-in measurements as required.

### **3.3 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.
  - 1. Grab Bars: As indicated on drawings.
  - 2. Other Accessories: As indicated on drawings.
- D. Mounting Heights and Locations: As required by accessibility regulations, as indicated on drawings, and as follows:

### **3.4 PROTECTION**

- A. Protect installed accessories from damage due to subsequent construction operations.

**END OF SECTION 10 28 00**

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**SECTION 10 43 00**

**EMERGENCY AID SPECIALTIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. First Aid Kit
- B. Portable Eyewash

**1.2 RELATED REQUIREMENTS**

- A. Section 06 10 63 - Miscellaneous Rough Carpentry: Wood blocking.

**1.3 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide color and finish, anchorage details, and installation instructions.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Emergency Aid Kit
  - 1. Product; Flinn First Aid Kit; SE1083.
  - 2. Include supplies for 50 people.
  - 3. Include wall mounting bracket.
- B. Portable Eyewash
  - 1. Haws: Model 7501; [www.hawsco.com](http://www.hawsco.com).
    - a. Portable Gravity Fed Eyewash
    - b. 9 gallon capacity
    - c. Including wall bracket.

**PART 3 EXECUTION**

**3.1 EXAMINATION**

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

**3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Wall Signs:

1. Location: Where shown.
2. Apply on walls after field painting is completed and has been accepted.

### **3.3 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training for additional requirements.

**END OF SECTION 10 43 00**



**SECTION 10 44 00**

**FIRE PROTECTION SPECIALTIES**

**PART 1 GENERAL**

**1.1 SECTION INCLUDES**

- A. Fire extinguishers.
- B. Fire Blanket and Cabinet.

**1.2 RELATED REQUIREMENTS**

- A. Section 06 10 63 - Miscellaneous Rough Carpentry: Wood blocking.

**1.3 REFERENCE STANDARDS**

- A. FM (AG) - FM Approval Guide; current edition.
- B. NFPA 10 - Standard for Portable Fire Extinguishers; 2017, with Errata (2018).

**1.4 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide extinguisher operational features, extinguisher ratings and classifications, color and finish, anchorage details, and installation instructions.
- C. Shop Drawings: Indicate locations of cabinets, cabinet physical dimensions, rough-in measurements for recessed cabinets, locations of individual fire extinguishers, mounting measurements for wall bracket, and installation procedures.
- D. Manufacturer's Installation Instructions: Indicate special criteria and wall opening coordination requirements.
- E. Maintenance Data: Include test, refill or recharge schedules and re-certification requirements.

**1.5 FIELD CONDITIONS**

- A. Do not install extinguishers when ambient temperature may cause freezing of extinguisher ingredients.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Fire Extinguishers:
  - 1. Activar Construction Products Group, Inc. - JL Industries; Cosmic 10E: [www.activarcpg.com](http://www.activarcpg.com).
  - 2. Ansul, a Tyco Business: [www.ansul.com](http://www.ansul.com).
  - 3. Kidde, a unit of United Technologies Corp: [www.kidde.com](http://www.kidde.com).
  - 4. Nystrom, Inc: [www.nystrom.com](http://www.nystrom.com).
  - 5. Oval Brand Fire Products: [www.ovalfireproducts.com](http://www.ovalfireproducts.com).
  - 6. Potter-Roemer; Model 3010: [www.potterroemer.com](http://www.potterroemer.com).

7. Pyro-Chem, a Tyco Business: [www.pyrochem.com](http://www.pyrochem.com).
8. Badger Fire Protection. ADV-10 Badger Advantage 10-21007867
9. Larsen's Manufacturing Co.; MP-10
10. Modern Metal Products; Wing 10HB
11. Substitutions: See Section 01 60 00 - Product Requirements.

B. Fire Blanket

1. Product: Flinn SE3006.
  - a. Including cabinet.

## 2.2 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. Cartridge Operated: Spun shell.
  2. Class: A:B:C type.
  3. Size: 10 pound.
  4. Finish: Baked polyester powder coat, red color.
  5. Temperature range: Minus 65 degrees F to 120 degrees F.

## 2.3 ACCESSORIES

- A. Lettering: FIRE EXTINGUISHER decal, or vinyl self-adhering, pre-spaced black lettering in accordance with authorities having jurisdiction (AHJ).

## PART 3 EXECUTION

### 3.1 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify rough openings for cabinet are correctly sized and located.

### 3.2 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Install cabinets plumb and level in wall openings, 48 inches from finished floor to inside bottom of cabinet.
- C. Secure rigidly in place.
- D. Place extinguishers on wall brackets.

**3.3 MAINTENANCE**

- A. See Section 01 70 00 - Execution and Closeout Requirements, for additional requirements relating to maintenance service.

**3.4 SCHEDULES - SEE DRAWINGS**

**END OF SECTION 10 44 00**

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**SECTION 10 51 13**

**METAL LOCKERS**

**PART 1 GENERAL**

**1.1 RELATED DOCUMENTS**

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

**1.2 SECTION INCLUDES**

- A. Metal lockers.

**1.3 RELATED REQUIREMENTS**

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete base construction.

**1.4 REFERENCE STANDARDS**

- A. TAS: Texas Accessibility Standards.
- B. ADA Standards - Americans with Disabilities Act (ADA) Standards for Accessible Design; 2010.
- C. ASTM A653/A653M - Standard Specification for Steel Sheet, Zinc-Coated (Galvanized) or Zinc-Iron Alloy-Coated (Galvannealed) by the Hot-Dip Process; 2020.
- D. ICC A117.1 - Accessible and Usable Buildings and Facilities; 2017.

**1.5 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Manufacturer's published data on locker construction, sizes and accessories.
- C. Shop Drawings: Indicate locker plan layout, numbering plan.
- D. Manufacturer's Installation Instructions: Indicate component installation assembly.

**1.6 DELIVERY, STORAGE, AND HANDLING**

- A. Protect locker finish and adjacent surfaces from damage.

**PART 2 PRODUCTS**

**2.1 MANUFACTURERS**

- A. Metal Lockers:
  - 1. Art Metal Products: [www.artmetalproducts.com](http://www.artmetalproducts.com).
  - 2. List Industries, Inc: [www.listindustries.com](http://www.listindustries.com).
  - 3. Lockers MFG: [www.lockersmfg.com](http://www.lockersmfg.com).
  - 4. Lyon Workspace Products: [www.lyonworkspace.com](http://www.lyonworkspace.com).

5. Penco Products, Inc: [www.pencoproducts.com](http://www.pencoproducts.com).
6. Republic Storage Systems Co: [www.republicstorage.com](http://www.republicstorage.com).
7. Tennsco Storage: [www.tennsco.com](http://www.tennsco.com).
8. WEC Manufacturing: [www.itswec.com](http://www.itswec.com).
9. Substitutions: See Section 01 60 00 - Product Requirements.

## **2.2 LOCKER APPLICATIONS**

- A. Athletic Lockers: Metal lockers, wall mounted for base indicated on drawings.
  1. Width: 15 inch.
  2. Depth: 15 inches.
  3. Height: 72 inches.
  4. Configuration: Two tier.
  5. Fittings: Size and configuration as indicated on drawings.
    - a. Upper shelf.
    - b. Lock box.
    - c. Coat rod.
    - d. Hooks: One single prong.
  6. Ventilation: Perforated side panels and doors.
  7. Locking: Padlock hasps, for padlocks provided by Owner.
  8. Provide sloped top.

## **2.3 METAL LOCKERS**

- A. Accessibility: Comply with TAS Standards, ICC A117.1 and ADA Standards.
- B. Lockers: Factory assembled, made of formed sheet steel, ASTM A653/A653M SS Grade 33/230, with G60/Z180 coating, stretcher leveled; metal edges finished smooth without burrs; baked enamel finished inside and out.
  1. Where ends or sides are exposed, provide flush panel closures.
  2. Provide filler strips where indicated, securely attached to lockers.
  3. Color: To be selected by Architect; allow for contrasting colors for locker bodies and doors.
- C. Locker Body: Formed and flanged; with steel stiffener ribs; electric spot welded.
  1. Body and Shelves: 24 gauge, 0.0239 inch.
  2. Base: 20 gauge, 0.036 inch.

- 3. Metal Base Height: 4 inch.
- D. Frames: Formed channel shape, welded and ground flush, welded to body, resilient gaskets and latching for quiet operation.
  - 1. Door Frame: 16 gauge, 0.0598 inch, minimum.
- E. Doors: Hollow double pan, sandwich construction, 1-3/16 inch thick; welded construction, channel reinforced top and bottom with intermediate stiffener ribs, grind and finish edges smooth.
  - 1. Door Outer Face: 18 gauge, 0.0478 inch, minimum.
  - 2. Door Inner Face: 20 gauge, 0.0359 inch, minimum.
  - 3. Form recess for operating handle and locking device.
- F. Hinges: Heavy duty, 7-knuckle type; two for doors under 42 inches high; three for doors over 42 inches high.
- G. Sloped Top: 20 gauge, 0.0359 inch, with closed ends.
- H. Trim: 20 gauge, 0.0359 inch.
- I. Coat Hooks: Stainless steel or zinc-plated steel.
- J. Number Plates: Provide oval shaped aluminum plates. Form numbers 2 inch high of block font style with ADA designation, in contrasting color.
- K. Locks: Locker manufacturer's standard type indicated above.
- L. Built-In Lock Boxes: Same material as locker, manufacturer's standard size, with padlock hasps, for padlocks provided by Owner.

### **PART 3 EXECUTION**

#### **3.1 EXAMINATION**

- A. Verify that prepared bases are in correct position and configuration.
- B. Verify bases and embedded anchors are properly sized.

#### **3.2 INSTALLATION**

- A. Install in accordance with manufacturer's instructions.
- B. Place and secure on prepared base.
- C. Install lockers plumb and square.
- D. Secure lockers with anchor devices to suit substrate materials. Minimum Pullout Force: 100 pounds.
- E. Bolt adjoining locker units together to provide rigid installation.
- F. Install end panels, filler panels, and sloped tops.
- G. Install fittings if not factory installed.
- H. Replace components that do not operate smoothly.

**3.3 CLEANING**

- A. Clean locker interiors and exterior surfaces.

**END OF SECTION 10 51 13**



SECTION 11 52 13

PROJECTION SCREENS

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Manually operated projection screens.
- B. Related Sections:
  - 1. Section 09 51 00 - Acoustical Ceilings; Direct Load Ceiling Clips.
  - 2. Section 09 91 23 – Interior Painting

1.2 SUBMITTALS

- A. Shop Drawings: Submit in accordance with SECTION 01 33 00 - SUBMITTAL PROCEDURES.
- B. Include manufacturer's installation instructions.

PART 2 - PRODUCTS

2.1 MATERIALS

- A. Manually Operated Projection Screen: Model B as manufactured by Da-Lite Screen Co., Inc. or Luma as manufactured by Draper, Inc.
  - 1. Mounting: Wall Mounted.
  - 2. Screen Fabric: Da-Lite or Draper "Matte White", flame- and mildew-resistant.
  - 3. Magnetic tie back.
  - 4. Case: 22-gage steel case with flat back design finished with baked enamel.
  - 5. Size: Video (16:10) format, 4'2" high x 6'8" wide.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install projection screens securely anchored to provide rigid installation. Screen shall be installed in strict accordance with manufacturer's instructions.

3.2 FIELD QUALITY CONTROL

- A. Certificate: The distributor or manufacturer's representative shall certify in writing to the Owner that the installation, adjustment and performance are in accordance with the manufacturer's recommendations.

3.3 ADJUST AND CLEAN

- A. Adjusting: Carefully adjust and regulate the projection screen after installation.
- B. Protection: Protect the completed work from damage. Replace damaged items which cannot be repaired.
- C. Cleaning: Upon completion of the building, clean the projection screen. Leave the screen free of defects and in ready-to-use condition.

END OF SECTION

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**SECTION 11 53 53**

**BIOLOGICAL SAFETY CABINET**

**PART 1 - GENERAL**

**1.1 SECTION INCLUDES**

- A. Goggle Sanitizing Cabinet

**1.2 RELATED REQUIREMENTS**

- A. Section 06 10 63 - Miscellaneous Rough Carpentry: Wood blocking.
- B. Division 26 or Section 26 05 83 - Wiring Connections: Electrical connections.

**1.3 SUBMITTALS**

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Show test results and performance charts.
- C. Manufacturer's Certificate: Certify that products meet or exceed specified requirements.

**1.4 DELIVERY, STORAGE, AND HANDLING**

- A. Package each piece of equipment to ensure protection from damage during shipment and delivery.
  - 1. Legibly indicate on the exterior of each container or crate, the shipping address and a brief description of its contents.
  - 2. Outside of the container, fasten a waterproof envelope containing a packing list and complete instructions for uncrating and setting the equipment in place.

**1.5 WARRANTY**

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

**PART 2 - PRODUCTS**

**2.1 MANUFACTURERS**

- A. Biological Safety Cabinet:
  - 1. Fisher Scientific. Eisco Goggle Sanitizing Cabinet; Model #GGSN10 ; [www.fishersci.com](http://www.fishersci.com).
  - 2. Flinn: Goggle Sanitizer Cabinet; Model # SE1000. [www.flinnsci.com](http://www.flinnsci.com).
  - 3. Substitutions: See Section 01 60 00 - Product Requirements.

**PART 3 - EXECUTION**

**3.1 EXAMINATION**

- A. Examine areas, with Installer present, for compliance with requirements for installation tolerances and other conditions affecting performance of biological safety cabinets.
- B. Proceed with installation only after unsatisfactory conditions have been corrected.

**3.2 INSTALLATION**

- A. Install biological safety cabinets in compliance with shop drawings and manufacturer's written instructions.

**3.3 CLOSEOUT ACTIVITIES**

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.

**3.4 SCHEDULE - SEE DRAWINGS**

**END OF SECTION 11 53 53**

SECTION 12 32 16

MANUFACTURED PLASTIC-LAMINATE-CLAD CASEWORK

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes:
  - 1. Plastic laminate-faced casework as shown on drawings.
  - 2. The fabrication and installation of standard casework components of base cabinets, wall cabinets, storage cabinets, wardrobe cabinets, shelf units and other units as indicated.
  - 3. The fabrication and installation of custom units, as detailed in the drawings.
- B. Related Sections:
  - 1. Section 06 10 63 – Miscellaneous Rough Carpentry; blocking.
  - 2. Section 08 14 16 - Flush Wood Doors
  - 3. Section 09 65 00 - Resilient Flooring; coved rubber base.
  - 4. Section 22 40 00 - Plumbing Fixtures and Fixture Carriers

1.2 SUBMITTALS

- A. Product Data: Submit in accordance with SECTION 01 33 00 - SUBMITTAL PROCEDURES.
- B. Include manufacturer's installation instructions for each type of casework unit.
- C. Samples: Submit 6" x 6" samples of specified finishes, including top material. Samples will be reviewed by Architect for color, texture and pattern only. Compliance with other specified requirements is exclusive responsibility of contractor.
- D. Shop Drawings:
  - 1. Submit shop drawings for plastic laminate-faced casework showing plans, elevations, ends and cross-sections. Show details and location of anchorages and fitting to floors, walls and base. Include layout of units with relation to surrounding walls, doors, windows and other building components.
  - 2. Coordinate shop drawings with other work involved.
- E. Mock-up Casework:
  - 1. Submit one full-size sample of finished base cabinet unit complete with hardware, doors and drawers, without finish top.
  - 2. Submit one full-size sample of finished wall-mounted cabinet unit complete with hardware, doors and adjustable shelves.
  - 3. Furnish both hinged and rolling door samples.
  - 4. Acceptable sample units will be used for comparison inspections at project. Unless otherwise directed, acceptable sample units may be incorporated in work. Notify Architect of their exact locations. If not incorporated in work, retain acceptable sample units in building until completion of work and remove sample units from premises when directed by Architect.

1.3 QUALITY ASSURANCE

- A. Single Source Responsibility: Provide casework with tops and accessories manufactured or furnished by same casework company for single responsibility.
- B. Catalog Standards:
  - 1. The use of catalog numbers and specific requirements set forth in drawings and specifications are not intended to preclude the use of other acceptable manufacturer's product or procedures which may be equivalent, but are given for purpose of establishing standard of design and quality for materials, construction and workmanship.
  - 2. Custom units shall be of the same quality as standard units specified.

- C. AWI Quality Standard: Comply with grades of interior architectural woodwork, construction, finishes and other requirements of the "Architectural Woodwork Standards", 2nd Edition, 2014, adopted and published jointly by Architectural Woodwork Institute (AWI), Architectural Woodwork Manufacturers Association of Canada (AWMAC), and Woodwork Institute (WI), except as otherwise indicated.
  - 1. Use Premium Grade, except use Economy Grade for millwork in custodian closets and storage rooms. Items not given a specific quality grade shall be Premium Grade.
- D. Color Uniformity: Provide plastic laminate for laminate-clad casework, plastic faced wood doors and plastic laminate toilet compartments from the same manufacturer.
- E. Manufacturer shall have at least 5 years' experience and have done installations for similar types of projects.
- F. Provide pre-installation coordination meeting for discussion of wood blocking locations for millwork and casework with rough carpentry trade.
- G. Accessibility Standards: The following special requirements shall be met, where required to comply with Texas Accessibility Standards (TAS).
  - 1. Countertop height with or without cabinet below, not to exceed a height required by TAS.
  - 2. Kneespace clearance to be minimum clearance as required by TAS.
  - 3. 12" deep shelving, adjustable or fixed not to exceed a range as required by TAS.
  - 4. Wardrobe cabinets to be furnished with rod/shelf adjustable to 48" A.F.F. at a maximum 21" shelf depth.
  - 5. Sink cabinet clearances as required by TAS.
  - 6. Cabinet locks, latches, and other operating mechanisms shall be mounted to comply with forward reach requirements of TAS; i.e. 15" to 48" above finish floor, except locked bottom drawers at base cabinets.

#### 1.4 DELIVERY, STORAGE, AND HANDLING

- A. Deliver plastic laminate-faced casework only after wet operations in building are completed.
- B. Store completed plastic laminate-faced casework in a ventilated place, protected from the weather, with relative humidity therein of 50% or less at 70°F.
- C. Protect finished surfaces from soiling and damage during handling and installation. Keep covered with polyethylene film or other protective covering. Woodwork damaged through neglect of the above requirements shall be repaired or replaced without additional cost to the Owner.

#### 1.5 ENVIRONMENTAL REQUIREMENTS

- A. Install finish carpentry products only when temperature and humidity conditions have been stabilized and will be maintained.
- B. Maintain temperature and moisture conditions as recommended by woodwork fabricator from date of installation through remainder of construction period.

#### 1.6 GUARANTEE

- A. Provide 5-year guarantee against defective materials and workmanship.

### PART 2 - PRODUCTS

#### 2.1 MANUFACTURERS

- A. Basis of Design: Manufacturer's catalog numbers for Case Systems, Inc. (website: [www.casesystems.com](http://www.casesystems.com), phone 989-496-9510) are shown on drawings and included in specifications for convenience in identifying certain cabinet work. Unless modified by notation on drawings or otherwise specified, catalog description for indicated number constitutes requirements for each such cabinet, hardware, or equipment.

- B. Subject to compliance with requirements of this specification, Case Systems, Inc. equivalent plastic laminate-faced casework as manufactured by one of the following will be acceptable:
- CIC Concepts in Cabinetry
  - Jericho Woodworks
  - Jim R. Reynolds & Assoc.
  - Stevens Industries

## 2.2 GENERAL

- A. Decorative laminate casework shall be Case Systems as specified or approved equal with the following minimum features:
1. Plywood for cabinet components
  2. PVC edges applied with hot melt.
  3. Epoxy coated, self closing, minimum 150# static rated drawer slides with lifetime warranty.
  4. Non-Racking, Non-Deflecting Platform Drawer Box With 1/2" Thick Bottoms.
  5. 1/2" Thick Cabinet Back.
  6. Toe Base – Marine Grade Plywood
  7. "Balanced" High pressure laminates applied with rigid PVA glue.
  8. Thermally Fused Laminate Interior, excluding backs of doors and drawers, complying with requirements of NEMA LD3, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10.
  9. Each Cabinet to have a factory applied, separate and full support toe base construction. See 2.5 below
  10. Colors and finishes shall be as selected by Architect.
  11. Casework shall be independently tested to meet the following minimum performance values:

Base Unit Racking	1460 lbf
Base Front Joint Loading	725 lbf
Wall Unit Racking	1600 lbf
Wall Unit Static Load	2500 lbf
Drawer Unit Static Load	1050 lbf
Drawer Front Joint Load	805 lbf
Drawer Side Joint Load	450 lbf
  12. Rail mounted casework shall be vertically and horizontally adjustable.
  13. Rail mounted casework shall have integral lower leveling bar, adjustable from inside of cabinet.
- B. Color and finish selections: Architect reserves the right to select one color for the exposed surfaces of the basic components of cabinets and a different color for the following components of cabinets: door and drawer fronts (including edges of door and drawer fronts), backs of open shelving and countertop and backsplash, unless shown otherwise.

## 2.3 MATERIALS

- A. Exterior Vertical Surfaces:
1. Door and drawer fronts and backs, finished end panels, and exposed exterior backs shall be surfaced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.
  2. Exterior vertical high-pressure laminate panels shall be balanced with textured .020" thick high-pressure cabinet liner conforming to NEMA Standard LD3-1995. Color as selected by Architect. Surface texture shall be similar to exterior finish.
  3. High-pressure laminate must be laminated using a PVA adhesive, set under pressure, resulting in a rigid glue line. Contact adhesives shall not be used.
  4. HPDL at open interiors, underside of wall cabinet bottoms, interiors of glazed door cabinets shall be considered exposed and finished in Decorative High-Pressure VGS laminate.
- B. Plastic Laminate: General purpose grade, HGS (0.048") high pressure decorative laminate meeting requirements of NEMA LD 3. Colors shall be as selected by Architect from full color, finish and pattern range of plastic laminate manufacturers listed. Product/manufacturer; one of the following:
- Formica Brand Laminate; Formica Corp.
  - Nevamar or Pionite Decorative Laminate; Panolam Industries.
  - Wilsonart; Wilsonart LLC.

- C. Thermally Fused Interiors at Semi-Exposed Surfaces: Interior surfaces behind doors, drawer boxes, backs, and unfinished ends shall be laminated with a thermally fused laminate that meets or exceeds the performance standards for NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Panels shall be of "BALANCED" construction. Fast cycle thermally fused, melamine foil or polyester surfaced panels or other surface types that do not meet these requirements are not acceptable. This excludes backs of doors and drawers, which shall be balanced with VGS (0.028") thick high-pressure decorative laminate conforming to NEMA LD3-1995.
  - D. 3mm PVC Edges: Door and drawer edging shall be 3mm PVC. The PVC shall be applied utilizing hot melt adhesive and radiused by automatic trimmers. Hand tool applying and trimming of PVC shall not be allowed. Edging shall be available in TWENTY-TWO coordinated color options. Color match.
  - E. ULEF/FSC (No added Urea Formaldehyde) Plywood:
    - 1. Plywood that meets or exceeds the standards set forth by the APA for structural use panels.
    - 2. For casework core being manufactured without the use of urea formaldehyde.
    - 3. For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.
  - F. FSC Plywood:
    - 1. For products having chain-of-custody certificates certifying that the wood used in the casework complies with FSC requirements.
- 2.4 General Cabinet Body Construction:
- A. Cabinet Box Style shall be Standard: Reveal Overlay.
  - B. Cabinet Box Core shall be ULEF/FSC Plywood or FSC Plywood.
- 2.5 Toe Base of Cabinet:
- A. Individual bases shall be constructed of: ULEF/FSC Marine Grade Plywood factory applied to base and tall cabinets and shall support and carry the load of the end panels, and the cabinet bottom, directly to the floor. The base shall be let in from the sides and back of the cabinet to allow cabinets to be installed tightly together and tight against a wall, also to conceal the top edge of applied vinyl base molding (not supplied by casework manufacturer). There shall be a front to back center support for all bases over 30" wide.
- 2.6 Drawer Fronts and Solid Doors:
- A. All drawer fronts and solid door components shall be: ULEF/FSC Plywood surfaced both sides for balanced construction.
- 2.7 Drawer Boxes:
- A. Drawer box constructed with a full 1/2" thick core shall be: ULEF/FSC Plywood or FSC Plywood] non-racking, non-deflecting platform bottom that is carried directly by "L" shaped, bottom mount drawer glides.
  - B. Drawer box at finished interiors shall be: Standard: Surface to Match Standard Interior
- 2.8 Shelves:
- A. Adjustable:
    - 1. Adjustable shelves shall be: ULEF/FSC Plywood or FSC Plywood core, with balanced surfaces.
  - B. Fixed:
    - 1. Fixed shelves shall be: ULEF/FSC Plywood FSC Plywood
- 2.9 CASEWORK HARDWARE AND ACCESSORIES
- A. Provide manufacturer's standard, satin finish hardware units, unless otherwise indicated.



- B. Hinges: Institutional type, 5 knuckle. Provide one pair for doors less than 4 ft. high and 1½ pair for doors over 4'. Mill ground hospital tip tight pin feature with edges eased. Hinge to be full wrap around type of tempered steel .095" thick. Each hinge to have minimum 9 #8 screws to assure positive door attachment.
- C. Wire Pulls: Solid brass with dual chrome finish, 4" wide, for drawers and swing doors, mounted with two screws fastened from back. Provide two pulls for drawers over 24" wide.
- D. Door Catches:
  - 1. Dual self-aligning, heavy-duty permanent magnet type with resistance in compliance with the Americans with Disabilities Act and Texas Accessibility Standards. Provide two catches on doors over 4' high.
  - 2. At double-leaf doors, provide lvs No. 2 catch for leaf without the lock. Four screws per catch.
  - 3. At each 1-1/8" doors, provide 1 flap stay No. 499.050.02.0215 or 499.050.03.0215 (Mepla) or approved equivalent.
- E. Drawer Slides and Accessories:
  - 1. Standard Drawers: Case DS230, self-closing design, epoxy powder coated with positive in-stop. Captive nylon rollers, front and rear. Minimum 100 lb. load rating.
  - 2. File Drawers: Case DS430, full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
  - 3. File Drawer Rails: Case FR010, file drawer box shall have full height sides supporting the plastic file rails for hanging file folders.
  - 4. Paper Storage Drawers: Full extension, 3-part progressive opening slide, minimum 100 lb., zinc plated or epoxy coated at manufacturer's option.
- F. Cabinet Base Molding: To be provided by General Contractor in field.
- G. Adjustable Shelf Supports: Provide twin pin design with anti tip-up shelf restraints for both ¾" and 1" shelves. Design to include keel to retard shelf slide-off, and slot for ability to mechanically attach shelf to clip. Load rating to be minimum 300 lbs. each support without failure. Cabinet interior sides shall be flush, without shelf system permanent projection. Product/manufacturer; one of the following, no substitutions:
  - 1. #3206 Shelf Support; Bainbridge Manufacturing, Inc.
  - 2. SC240 Plastic Shelf Clip; Case Systems, Inc.
  - 3. Cat. No. 282.47.402; Häfele
  - 4. Clear Polycarbonate Shelf Clip; TMI System Design Corp.
- H. Wardrobe Rod: To be 1-1/16" rod, Knappe & Vogt No. 660, supported by Knappe & Vogt No. 632 CHR flanges.
- I. Adjustable shelves shall be plywood core, balanced surfaces and have a .020-inch thick PVC front edge. Per AWI, shelving shall not deflect in excess of 1/4-inch when loaded.
  - a. Adjustable shelves behind doors, 3/4-inch thick to 27 inches wide, over 30 inches wide shall be 1 inch thick min.
  - b. Adjustable shelves in open cabinets shall be 1 inch thick, except for special use cabinets such as mail, cubical or locker type units.
  - c. There shall be no play in adjustable shelves 1/16-inch each end, max.
- 2. Fixed Interior Components such as fixed shelves, dividers, and cubicle compartments shall be full 3/4-inch thick plywood attached with concealed interlocking mechanical fasteners.
- J. Shelf and Rod Hardware:
  - 1 hanger rod KV660SS
  - 1 shelf and rod support KV1195
  - 2 rod flanges KV734
  - wood dowel connectors
- K. Countertop Support Bracket: Case Systems, Inc. Model X0670
  - 1. 11 gauge construction
  - 2. Powder-coated finish in color as selected by Architect.
  - 3. Load rating of 200 lbs. per lineal foot.
- L. Grommets: Model No. LO-3 as manufactured by Doug Mockett & Co., Inc.

## 2.10 CONSTRUCTION

- A. Wall Cabinets:

1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
  2. Wall cabinet bottoms shall be of 1" thick plywood core mechanically fastened to end panels and secured to the bottom back stretcher.
  3. An upper 3/4" thick stretcher shall be located behind the back panel with two interlocking mechanical fasteners per end. Also the stretcher is secured to the cabinet top with #8 x 2" plated flat head screws.
  4. A lower 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. The stretcher is also secured to the cabinet bottom.
- B. Base Cabinets:
1. Each end panel to be secured with a minimum of seven interlocking mechanical fasteners for a total tensile strength of 2,450 pounds.
  2. Base cabinets, except sink cabinets, shall have a solid 3/4" thick sub-top fastened to the ends with interlocking mechanical fasteners.
  3. Each kneespace to have apron with dimensions per drawings.
  4. Provide 1-1/2" thick dividers between kneespaces and adjacent spaces (e.g. dishwasher openings, other kneespaces, etc.)
  5. Sink cabinets shall have a vertically mounted front stretcher panel supporting the countertop, a split removable back panel, and four steel corner gussets used to secure the counter-top.
  6. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
  7. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.
- C. Tall Cabinets:
1. Each end panel to be secured with a minimum of eleven interlocking mechanical fasteners for a total tensile strength of 3,850 pounds.
  2. An intermediate fixed shelf shall be provided on general storage cabinets to maintain internal dimensional stability under heavy loading conditions.
  3. An upper 3/4" thick stretcher shall be located behind the back panel and attached to the end panels with interlocking mechanical fasteners. This stretcher is also fastened to the full sub-stop thus capturing the back panel.
  4. An intermediate 3/4" thick stretcher shall be located behind the back panel and be secured to the cabinet ends with interlocking mechanical fasteners. Where an intermediate shelf is present, the stretcher shall also be secured to the shelf with a #8 x 2 plated flat head screw.
  5. Drawers with 1/4" bottoms requiring hot melt glue or intermediate supports will not be permitted. No exceptions will be permitted.
  6. Sub-Base: Each cabinet to have a factory applied, continuous, separate and fully supportive toe base construction (no cabinet body sides-to-floor) with concealed fastening to cabinet bottom. Subbase shall be recessed at sides of end cabinets for rubber base installation.
- D. Drawers:
1. Drawer box shall be constructed with a full 1/2" thick non-racking, non-deflecting platform bottom which is carried directly by "L" shaped, bottom mount drawer glides. Sides are secured with 1 1/4" long screws directly into platform and into the sides.
  2. Sides, back, sub-front and bottom shall be 1/2" thick 47# density plywood surfaced both faces with Light Beige, Greystone, or White thermally fused laminate per 2.02.B.1. The top edge shall be .020" PVC matching the drawer color.
  3. Corners shall be joined with fluted hardwood dowels and glue, minimum 32mm o/c.
  4. Drawer fronts shall be removable and attached drawer box sub-front with screws from inside of drawer.

## 2.11 COUNTERTOPS

- A. High-Pressure Decorative Laminate, Nominal 1 1/8" Thick Countertop:
1. General Purpose, HGS (0.048") high-pressure decorative laminate on horizontal surface, conforming to NEMA Standard LD3-1995.
  2. Laminate bonded to 1" thick 47# M-3 particleboard core with PVA rigid adhesives. Contact method shall NOT be allowed. Core shall be balanced with HPL backer.
  3. Joints shall be secured with adhesive and tight joint fasteners.
  4. Provide 4" high back splashes where shown and at ends abutting walls and adjacent cabinets.
  5. Countertops shall conform to ANSI A161.2-1979 PERFORMANCE STANDARDS FOR FABRICATED HIGH-PRESSURE DECORATIVE LAMINATE COUNTERTOPS.
  6. No joints shall be closer than 24" either side of sink cutout.

7. No joints shall occur within kneespace.
8. Countertops containing sinks and countertops over dishwashers shall be exterior-grade veneer core plywood or moisture resistant medium density fiberboard, no substitutions.
9. Joint between backsplash and countertops containing sinks shall be sealed with sanitary, silicone sealant to ensure a tight seal.
10. Seal substrate at sink cutouts with sanitary, silicone sealant.

## 2.12 PERFORMANCE

- A. Laminates:
1. "High Pressure Laminates" shall meet the definition and performance requirements of NEMA LD3-1995. Vertical grade laminate shall be VGS (0.028") balanced with a VGS. Countertops shall be HGS (0.048").
  2. Thermally Fused Laminate shall meet the performance requirements of NEMA LD3-1995, Grade VGL, for Test Methods 3.3, 3.4, 3.6, 3.8, and 3.10. Cabinet manufacturer shall submit panel manufacturers' current published specification stating ANSI core properties and NEMA finish properties.
- B. Hinges: ANSI 156.9.4.1,2,3,4: Two hinges mounted 23" on center on a 23-7/16" wide x 19-11/16" high cabinet door shall be capable of supporting a 100 pound test load located 1" from the outside edge of the door.
1. Cycle, open and close, from 5 degrees open through 95 degrees open with no failure to hinges, door, or cabinet end panel. The maximum horizontal permanent hinge set shall not exceed .030".
- C. Drawers: ANSI/BHMA A156.9-1988 4.11: an actual production drawer box with an applied finished front and 450mm drawer slides mounted per the manufacturers' instructions shall be tested as follows:
1. Dynamic Cycle Test: When uniformly loaded with 100 pounds and tested through 50,000 opening and closing cycles, the drawer shall operate freely.
  2. Static Edge Load Test: When the drawer is fully extended, a 150 pound load shall be supplied to the drawer front at a point on the centerline of the drawer for one minute. No permanent damage or distortion shall occur.
- D. Adjustable Cabinet Shelving: Shelving shall not deflect in excess of 1/4" when loaded with calculations per AWI Standards.

## 2.13 FABRICATION

- A. Fabricate plastic laminate-faced casework to dimensions, profiles and details shown.
- B. Assemble units in the shop in as large components as practicable to minimize field jointing.
- C. Install hardware uniformly and precisely after final finishing is complete. Set hinges snug and flat in mortises unless otherwise indicated. Turn screws to a flat seat. Adjust and align hardware so that moving parts operate freely and contact points meet accurately. Allow for final field adjustment after installation.

## PART 3 - EXECUTION

### 3.1 PREPARATION

- A. Verify site dimensions of cabinet locations in building prior to fabrication.
- B. Verify location of wood blocking prior to installation of finish carpentry.

### 3.2 CASEWORK INSTALLATION

- A. Installers: Install casework under the supervision of the manufacturer's representative with factory-trained mechanics certified by manufacturer.
- B. General: Install plumb, level, true and aligned with no distortions. Shim as required, using concealed shims. Where casework abuts other finished work or walls, scribe and apply filler strips for accurate fit with fasteners concealed where practicable.
- C. Base Cabinets:
1. Set cabinets straight, plumb and level. Adjust sub-tops within 1/16" of a single plane. Fasten each individual cabinet to blocking in wall with screws and finishing washers spaced 24" o.c. Bolt adjacent

cabinets together into one integral unit with joints flush, tight, and uniform. Align similar adjoining doors and drawers to a tolerance of 1/16".

2. Where base cabinets are not installed adjacent to walls, fasten to floor at toe space with fasteners spaced 24" o.c. Secure sides of cabinets to floor, where they do not adjoin other cabinets, with not less than two fasteners.
- D. Wall Cabinets
1. Securely fasten to solid blocking in partitions (not plaster, lath, or wallboard). Anchor, adjust and align wall cabinets as specified for base cabinets. Using screws with finishing washers, securely fasten each cabinet through back, near top, at not less than 24" o.c. Align similar adjoining doors to a tolerance of 1/16".
  2. Adjust fronts and bottoms within 1/16" of a single plane.
  3. Reinforcement of stud walls to support wall-mounted cabinets will be done during wall erection by trade involved, but responsibility for accurate location and sizing of reinforcement is part of this work.
- E. Adjust casework and hardware so that doors and drawers operate smoothly without warp or bind. Lubricate operating hardware as recommended by manufacturer.

### 3.3 INSTALLATION OF TOPS

- A. Field Jointing: Where practicable, make in same manner as factory jointing using dowels, splines, adhesives and fasteners recommended by manufacturer. Locate field joints as shown on accepted shop drawings, factory prepared so there is no jobsite processing of top and edge surfaces.

- B. Fastenings: Use concealed clamping devices for field joints, located within 6" of front, at back edges and at intervals not exceeding 24". Tighten in accordance with manufacturer's instructions to exert a constant, heavy clamping pressure at joints. Secure tops to cabinets with "Z"-type fasteners or equivalent, using two or more fasteners at each front, end and back.
- C. Workmanship:
  - 1. Abut top and edge surfaces in one true plane, with internal supports placed to prevent deflection. Provide flush hairline joints in top units using clamping devices.
  - 2. After installation, carefully dress joints smooth, remove surface scratches, clean and polish entire surface.
  - 3. Provide holes and cutouts as required for mechanical and electrical service fixtures.
  - 4. Provide scribe moldings for closures at junctures of top, curb and splash with walls as recommended by manufacturer for materials involved. Use permanently elastic sealing compound recommended by manufacturer.

### 3.4 INSTALLATION OF ACCESSORIES

- A. Install in a precise manner in accordance with manufacturer's directions. Turn screws to a flat seat; do not drive. Adjust moving parts to operate freely without excessive bind.
- B. Install grommets at knee spaces where electrical/telephone/data outlets are installed below countertop, whether detailed on drawings or not.

### 3.5 CLEANING AND PROTECTION

- A. Clean Up: Remove cartons, debris, sawdust, scraps, etc., and leave spaces clean and casework ready for Owner's use.
- B. Repair or remove and replace defective work as directed upon completion of installation.
- C. Clean shop-finished surfaces, touch-up as required and remove or refinish damaged or soiled areas, as acceptable to Architect.
- D. Protection: Advise contractor of procedures and precautions for protection of materials and installed plastic laminate-faced casework from damage by work of other trades.

END OF SECTION

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**SECTION 14 41 00**

**OVERHEAD BARRIER-FREE LIFT**

**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: Ceiling-mounted personnel transfer system.

**1.3 RELATED SECTIONS:**

- A. Section 05 50 00 - Metal Fabrications.
- B. Section 06 10 00 - Rough Carpentry.
- C. Section 09 51 00 - Acoustical Ceilings.

**1.4 DEFINITIONS**

- A. Ceiling Mounted Personnel Transfer System includes remote hand control, battery charging system patient slings, warranty and devices as indicated and required for the safe operation of the ceiling mounted personnel transfer system

**1.5 SUBMITTALS**

- A. Shop Drawings: Submit in accordance with SECTION 01 33 23 - SHOP DRAWINGS, PRODUCT DATA AND SAMPLES. Include manufacturer's installation instructions and track layout.

**1.6 WARRANTY**

- A. Provide manufacturer's standard warranty for ceiling mounted personnel transfer system that matches or exceeds:
  - 1. 2 years on all overhead lift system parts
  - 2. 2 years on all labor

**PART 2 - PRODUCTS**

**2.1 MATERIALS**

- A. Provide ceiling-mounted battery operated personnel transfer system complete with sling, straight and curved track system as manufactured by V. Guldmann A/S (phone 800.664.8834 web site: [www.guldmann.com](http://www.guldmann.com)) or approved equal.
- B. Load Rating 385 lbs.
- C. Travel (up/down) 6.5 ft.
- D. Charger 110V/24V-1A
- E. Battery 24 volt D.C.

F. Max. Current 10 amps

G. Battery Capacity 24V/6.5 Ah

### **PART 3 - EXECUTION**

#### **3.1 INSTALLATION**

A. Install transfer system securely anchored to provide rigid installation. Lift shall be installed in strict accordance with manufacturer's instructions.

#### **3.2 FIELD QUALITY CONTROL**

A. Certificate: The distributor or manufacturer's representative shall certify in writing to the Owner that the installation, adjustment and performance are in accordance with the manufacturer's recommendations.

#### **3.3 ADJUST AND CLEAN**

A. Adjusting: Carefully adjust and regulate the transfer system after installation.

**END OF SECTION 14 41 00**



SECTION 21 01 00

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect / Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element.
  - 2. Contractor information.
  - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
  - 4. All parts and maintenance manuals for items of equipment.
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates).
  - 9. Control operations/equipment wiring diagrams.
  - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect / Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".  
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

FIRE PROTECTION OPERATING AND MAINTENANCE MANUALS

### PART 3 - EXECUTION

#### 3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
  - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
  - 2. Format:
    - a. Size: 8-1/2" x 11".
    - b. Text: Manufacturer's printed data or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable.
    - c. Identity of general subject matter covered in the manual.
  - 6. Binder as specified.
- B. Content of Manual:
  - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number.
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each
      - 4) Local source of supply for parts and replacement
    - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  - 2. Product Data:
    - a. Include those sheets pertinent to the specific product
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed
      - 2) Identify data applicable to installation
      - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
  - 3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  - 4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  - 5. Copy of each warranty, bond and service contract issued.
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  - 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
  - 1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts
      - 1) Function, normal operating characteristics, and limiting conditions
      - 2) Performance curves, engineering data and tests
      - 3) Complete nomenclature and commercial number of replaceable parts.
    - b. Operating procedures:

- 1) Start up, break-in, routine and normal operating instructions.
    - 2) Regulation, control, stopping, shut down and emergency instructions.
    - 3) Summer and winter operating instructions.
    - 4) Special operating instructions.
  - c. Maintenance procedures:
    - 1) Routine operations
    - 2) Guide to trouble-shooting.
    - 3) Disassembly, repair and reassembly.
    - 4) Alignment, adjusting and checking.
    - 5) Routine service based on operating hours.
  - d. Servicing and lubrication schedule. List of lubricants required.
  - e. Manufacturer's printed operating and maintenance instructions.
  - f. Description of sequence of operation by control manufacturer.
  - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - 1) Predicted life of part subject to wear.
    - 2) Items recommended to be stocked as spare parts.
  - h. As installed control diagrams by controls manufacturer.
  - i. Complete equipment internal wiring diagrams.
  - j. Each Contractor's coordination drawings.
  - k. As installed color coded piping diagrams.
  - l. Charts of valve tag number, with location and function of each valve.
  - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
  - n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
  4. Provide complete information for products specified in Division 21.
  5. Provide certificates of compliance as specified in each related section.
  6. Provide start up reports as specified in each related section.
  7. Provide signed receipts for spare parts and material.
  8. Provide training report and certificates.
  9. Provide backflow preventer certified test reports.

END OF SECTION

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SECTION 21 05 00

FIRE PROTECTION GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions and Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 21 Fire Sprinkler Systems.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department
  - 5. Texas Department of Licensing & Regulations (TDLR)
  - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings

FIRE PROTECTION GENERAL PROVISIONS

with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's seal, name, address and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, etc. that were deviated from construction drawings.
  - 6. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 7. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 8. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
  - 9. Exact location of all electrical equipment in and outside of the building.
  - 10. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
  - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 12. Cloud all changes.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

#### 1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

#### 1.10 GUARANTEE

### FIRE PROTECTION GENERAL PROVISIONS

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 21 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing

FIRE PROTECTION GENERAL PROVISIONS

equipment, and as shown on the drawings.

B. Concrete work as specified in Division 3.

C. Concrete pads:

1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
2. Chamfer strips at edges and corner of forms.
3. Smooth steel trowel finish.
4. Doweled to existing slab

D. Install concrete curbs around multiple pipe penetrations.

### 3.3 VANDAL RESISTANT DEVICES

A. Provide a handle for each loose keyed operated valve and hose bibb on the project.

B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.

C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

### 3.4 INSTRUCTION OF OWNER'S PERSONNEL

A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.

1. Provide the training during the Owner's regular working day.
2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.

B. Time to be allocated for instructions.

1. Minimum of 4 hours dedicated instructor time.
2. 2 hours on each of 2 days.

C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.

1. One copy to the Owner.
2. One copy to the Architect/Engineer.

D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.

E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.

F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.

G. Demonstrate equipment functions (both individually and as part of the total integrated system).

H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.

I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.

J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### FIRE PROTECTION GENERAL PROVISIONS



3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
  - 1. Designation approved by Architect/Engineer.
  - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
  - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

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SECTION 21 05 10

FIRE PROTECTION CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 21 05 12

FIRE PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- C. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale:  $\frac{1}{4}" = 1'-0"$ .
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
  - 1. Actual mechanical equipment and components to be furnished
  - 2. Service clearance
  - 3. Relationship to other equipment and components
  - 4. Roof drains and leader piping
  - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
  - 1. Ductwork shop drawings
  - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply", "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

#### PROTECTION SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
  - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and address
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
  - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items which require correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a re-submittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions,

field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule
  - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION



SECTION 21 05 13

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as fire protection work are indicated in other Division 21 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as fire protection, specified or partially specified in this Section, include but are not necessarily limited to the following:
  - 1. Motors for fire protection equipment.
  - 2. Starters for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 3. Wiring from motors to disconnect switches or junction boxes for motors of fire protection equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 4. Wiring of field-mounted float control switches, flow control switches, and similar fire protection-electrical devices provided for fire protection systems, to equipment control panels.
  - 5. Pipe heat tracing.
- C. Refer to Division 21 sections for specific individual fire protection equipment electrical requirements.
- F. Refer to Division 26 sections for motor starters and controls not furnished integrally with fire protection equipment.
- G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of fire protection equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of fire protection work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Provide motors for fire protection equipment manufactured by one of the following:
  - 1. Baldor Electric Company.
  - 2. Century Electric Div., Inc.
  - 3. General Electric Co.
  - 4. Louis Allis Div.; Litton Industrial Products, Inc.
  - 5. Lincoln Electric
  - 6. Marathon Electric Mfg. Corp.

ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

7. Reliance Electric Co.
  8. Westinghouse Electric Corp.
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of fire protection equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of fire protection work:
- C. Temperature Rating. Rated for 40°C environment with maximum 50°C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 21 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
1. Frames. NEMA #56.
  2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 21 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
  3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 21 for other enclosure requirements.
  4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
  5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.

## 2.2 EQUIPMENT FABRICATION

- A. Fabricate fire protection equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in fire protection work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

## ELECTRICAL PROVISIONS OF FIRE PROTECTION WORK

SECTION 21 05 14

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information.

FIRE PROTECTION ALTERATIONS PROJECT PROCEDURES

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse, or abandon.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

### 3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
- C. Existing Fire Protection Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing fire protection systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping coincident with the construction.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING FIRE PROTECTION WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Fire protection piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing fire protection installation, or as specified.
- H. Existing fire protection piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

### 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing equipment in renovated areas as specified in Section 21 05 00 Fire Protection General Provisions.

END OF SECTION

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SECTION 21 10 00

FIRE SPRINKLER SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Design coordination of sprinkler work with the installations of other trades as shown on their drawings; all mechanical, electrical, plumbing and sprinkler work must fit the space requirements. The sprinkler work shall comply with other Sections of this specification; and fit the structure finishes. The Sprinkler Contractor will comply with all the codes and underwriter authorities, and the requirements for the installation of inside and outside piping; including sprinkler heads, valves, tamper switches, flow switches, hangers and supports, sleeves, fire department connections, inspector test connections, main drain and accessories, signs and any other component parts reasonably incidental to providing a complete protection system. Provide sprinklers where renovations shown on Architectural drawings.
- B. A wet system shall be installed in heated areas and dry pipe systems in areas subject to freezing. When heated areas are not available and dry pipe system not used, provide heat tracing and / or insulation installed per NFPA and per local Fire Marshall Requirements, or as indicated on drawings.
- C. Furnish all articles of a completed sprinkler system including all materials, labor, tools, equipment, transportation services and supervision fees.
- D. The plans provide a riser assembly location at water entry into building for flow switch locations, valve locations (with tamper switches), fire department test assemblies and fire department Siamese connections. These are a guide for subsequent preparation of the Contractor's detailed installation drawings of the complete fire protection sprinkler system which shall be submitted to the Architect / Engineer for review. Submit only drawings and calculations bearing the approval of the authority having jurisdiction.
- E. Do not exceed 52,000 square feet of building for each individual sprinkler system.
- F. Install fire protective system identification signs in accordance with NFPA-13, NFPA-14, and NFPA-20
- G. It shall be the fire protection installer's responsibility to verify pressure at the project site by performing a flow test. Determine if the available static pressure, residual pressure and flow rate will adequately provide the fire extinguishing system with the necessary operating requirements or if a fire pump, storage tank and necessary appurtenances are required. Notify Architect and Engineer if low water flow / pressure condition exist and inform them of all options prior to proceeding.
- H. The installation of the entire Sprinkler Systems shall comply with all rules and regulations of the National Board of Fire Underwriters, the Local Building Code, Local Fire Marshall, and Requirements of NFPA Pamphlet 13, and other local authorities exercising jurisdiction.
- I. Study the general, structural, electrical and mechanical drawings and specifications, in order to become familiar with the building and details as they apply to the work of this Section. Cooperate with all Trades so that there will be no conflict of space. Plumbing flow lines, large ductwork HVAC piping and electrical service feeders shall take precedence over Fire Protection work, except where it is absolutely necessary to maintain coverage protection.

1.2 BASIS OF DESIGN

- A. National Fire Protection Association (NFPA), latest edition of NFPA 13, Standard for the Installation of Sprinkler Systems.
- B. Vertical zone valves installed in horizontal position are not acceptable. All zone valves are to be located at water entry into building and mounted in the vertical riser.

FIRE SPRINKLER SYSTEMS

### 1.3 QUALITY ASSURANCE

- A. Sprinkler equipment and installation to be in accordance with recommendations of and approved by local, state and federal fire authorities.
- B. Equipment and installation to meet requirements of NFPA No. 13, 14, 20, 24, 25, 70 and 72.
- C. Use materials and equipment that are new and of unused, approved by NFPA and as listed in the UL list of "Inspected Fire Protection Equipment and Materials."

### 1.4 SHOP DRAWINGS

- A. Make complete shop drawings and working drawings of equipment furnished, including detailed drawings of piping and sprinkler head locations. Drawings shall show construction details and dimensions of each piece of equipment and work to be installed. The location of all heads shall be as approved. Where additional heads are required to meet NFPA 13, provide at no additional cost.
- B. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the jurisdictions for approval. All approvals shall be noted on the drawings or by letter from the departments.
- C. The Architect's approval of shop drawings shall not relieve the responsibility of correctly figured dimensions or any errors that may be contained in these drawings. The omission of any material shown on the contract drawings, or specified from the shop drawings, even though approved, shall not relieve the responsibility to furnish and erect them.
- D. Provide ¼ scale drawings to show the location of the water entry into building with all zone valves, and shut-off valves, with alarms and drains at this location. Prepare the sprinkler drawings under the work of this Section.
- E. Submit samples of all sprinkler types for approval.

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Johnson Controls (Tyco Fire Products)
  - 1. Gem/Grinnell
  - 2. Central
  - 3. Star Sprinkler
- B. Automatic Sprinkler Company of America
- C. Potter Roemer, Inc.
- D. The Reliable Automatic Sprinkler Company
- E. Viking Corporation
- F. Victaulic Company of America
- G. Globe Fire Sprinkler Corporation

### 2.2 PIPING AND FITTINGS

- A. Above Slab Inside Building
  - 1. Pipe 2" and Smaller: Schedule 40, black steel pipe conforming to ASTM A 795 or ASTM A135 joined with threaded fittings.
  - 2. Pipe 2-1/2" and larger, provide ASTM A795 or ASTM A135 UL and FM listed.
    - a. Schedule. 40, black steel pipe joined with rolled grooved fittings.



- B. Underground within five feet of building. Provide ductile iron pipe, Class 200 conforming to ASTM, and ring-tite fittings. Provide concrete thrust blocks at changes in direction, according to the pipe manufacturer's recommendations.
- C. All piping shall be black carbon steel, except in dry systems where pipe shall be galvanized per ASTM A53.
- D. Fittings used to join pipe shall be listed fabricated fittings or manufactured in accordance to the material and dimension standards listed in table 6.4.1 NFPA 13 and 2.2.1 NFPA 14.

## 2.3 SPRINKLER HEAD

- A. All sprinklers shall comply with the latest requirements of NFPA 13 with respect to orifice size.
- B. All heads shall be UL listed and/or FM approved, and comply with the latest requirements of NFPA 13 with respect to orifice size unless otherwise noted. Sprinkler heads with "O" ring design shall not be acceptable.
- C. Exposed areas:
  - 1. Standard upright type with brass finish and escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
  - 2. Tyco Model B, FRB, Globe Model GL-QR, GL-SR, or approved equal
- D. Sidewall applications:
  - 1. Horizontal sidewall type with brass finishes and chrome escutcheon.
  - 2. Unfinished areas and recessed with chrome plated escutcheon. Provide temperature rating per NFPA 13 and UL/FM approvals.
  - 3. Tyco Model B, FRB, Globe Model GL-QR/SW, GL-SR/SW, or approved equal.
- E. Suspended ceilings:
  - 1. Adjustable drop down deflector type concealed heads with manufacturer painted white cover plate with glass bulb fusible link. Provide temperature rating per NFPA 13 and UL/FM approvals.
  - 2. Color of plate, selected by Architect
  - 3. Tyco Series RFII; Series ELOC, Globe Concealed Models GL-QR/INCH, GL-SW/INCH and GL-INCH/ECLH or approved equal.
- F. Dry sprinklers heads at freezers and coolers
  - 1. Tyco Model DS-1, DS-2, or approved equal.
- G. Sprinklers subject to mechanical injury shall be protected with fusible solder type sprinklers and listed heavy duty bolt on guards. Bulb type sprinklers will not be acceptable for these locations.
  - 1. Storage rooms with exposed structure.
  - 2. Gymnasiums.
  - 3. Mechanical and Electrical rooms.
  - 4. Below exposed stairs.
  - 5. Exposed structure areas.
- H. Systems serving walk-in freezers shall utilize Tyco Model DS-1 or DS-C dry pendent sprinklers. A Model DSB-1 dry sprinkler boot shall be utilized in conjunction with the dry sprinkler to eliminate the requirement for insulation and to stop potential air interchange. Length of dry pendent shall be determined by manufacturer's recommendation with respect to freezer ambient temperatures expected.

## 2.4 INSPECTOR'S TEST CONNECTION

- A. Provide inspector's test connection as required by NFPA 13.
  - 1. Ductile iron module housing with combination sight glass, orifice and bonnet assembly
  - 2. UL listed
  - 3. Victaulic No. 718
  - 4. Globe Model UTD
  - 5. Tyco, or approved equal

## FIRE SPRINKLER SYSTEMS

## 2.5 TAMPER SWITCH / SUPERVISORY SWITCH

- A. Tamper switch on each valve
  1. Controlling or shutting off sprinkler system or any portion thereof.
  2. Tamper switch with either one single pole, double throw switch or two single pole, double throw switches as required.
  3. Switch shall be compatible with installed valve for standard mounting.
  4. Potter-Roemer Fig. 6220, 6221, 6222, 6223 or approved equal.

## 2.6 FLOW SWITCH

- A. Vane type flow switch.
  1. Self-contained pneumatic, adjustable retard.
  2. Two, single pole, double throw switches.
  3. Red enamel tamper proof switch housing with flow paddle.
  4. Potter Roemer Model No. 6200, or approved equal.

## 2.7 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

## 2.8 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

## 2.9 GASKETS

- A. Use 1/16-inch thick preformed synthetic rubber bonded.

## 2.10 COUPLINGS

- A. Use listed rolled grooved mechanical couplings to engage and lock grooved or shouldered pipe ends and to allow for some angular deflection, contraction and expansion. Coupling consists of ductile iron housing, c-shaped composition sealing gasket and steel bolts. Gasket Material for dry pipe systems shall be silicone and listed for dry pipe service.

## 2.11 VALVES

- A. Use valves suitable for 175 psig WOG.
- B. Valves to be UL listed and FM approved.
- C. Valve Connections:
  1. Provide valves suitable to connect adjoining piping as specified for pipe joints. Use full line size valves unless noted otherwise.
  2. Screwed ends for pipe sizes 2 inches and smaller.
  3. Flanged ends for pipe sizes 2-1/2 inches and larger.
  4. Solder or screw to solder adapters for copper tubing.
  5. Use grooved body valves with mechanical grooved jointed piping.
- D. Gate Valves:
  1. Up to 2 inches, bronze, outside screw and yoke, rising stem, solid wedge, screwed ends, manufactured by: Mueller, or approved equal.
  2. Over 2 inches, iron body, bronze trim, outside screw and yoke, rising stem, solid wedge, flanged ends; manufactured by Mueller, or approved equal.
- E. Check Valves:
  1. Up to 2 inch, bronze, regrind bronze swing disk, solder or screwed ends; 200 WOG, manufactured by Mueller, or approved equal.

## FIRE SPRINKLER SYSTEMS

2. Over 2 inch, iron body bronze trim, swing disk, regrind – renew bronze disk and seat, flanged ends; 200 WOG, manufactured by Mueller, Globe Model RCV, or approved equal.
- F. Butterfly Valve: Lug body style, bubble-tight shutoff, cast iron body, ASTM B 148 bronze disk, with integral tamper switch, manufactured by Anvil Model No. 8000 FP, or approved equal.
- G. Freestanding Indicating Post: Install adjustable indicating post and valve outside building where shown on Civil drawings, consisting of UL/FM, non-rising stem gate valve and indicating post. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.
- H. Wall post-adjustable indicating valve: Outside building at water entry location into building, consisting of UL/FM, non-rising stem gate valve and indicator. Gate valve shall be iron body, non-rising stem, bronze mounted. Indicator flange, 175-psi non-shock rating, flanged end. Indicator shall be UL/FM approved cast iron body, Plexiglas window and 18-inch adjustment span with handle and tamper switch wired to main fire alarm control panel, manufactured by Mueller, Valve No. A-2052, Indicating Post No. A20800, or approved equal.

## 2.12 ELECTRIC ALARM BELL

- A. 10-inch round red enamel steel bell with electrically operated vibrating outdoor alarm bell, UL listed, red enamel steel, manufactured by Simplex, or approved equal.

## 2.13 GAUGES

- A. Gauges shall be bourdon tube type with minimum 4-1/2 inch dial and die cast aluminum case with screwed ring and black enamel finish. The movement shall be all stainless steel with Grade A phosphor bronze bourdon tube, brazed at socket and tip. The accuracy of the gauge shall be within one-half of one percent of the scale range. The pointer shall be the micrometer adjustment type recalibrated from the front. Pressure and compound gauges shall have suitable scale ranges and graduations. Suitable for temperatures up to 120 degrees F.
- B. Gauges shall have 1/4 inch connections and be mounted with combination stop / snubber needle valve with suitable pressure rating. Scale ranges: 0-200 psi.
- C. Gauge range shall be such that system normal operating pressure falls with 25 percent and 75 percent of the full-scale range.
- D. Pressure scale graduations shall read in psig. Figure intervals shall be in – 20 psig increments, with minor divisions in 2 psig increments.
- E. The accuracy of the gauge shall be at least 0.5 percent of the scale range. Gauge shall be made in accordance with ASME B40.1 accuracy grade 2A.
- F. Manufactured by:
  1. Terice Model No. 4500 Series
  2. Ashcroft
  3. Marsh
  4. Weksler

## 2.14 SPARE SPRINKLER HEAD BOX

- A. Provide baked enamel steel box to store 36 sprinkler heads (Minimum of 3 of each type used) for emergency replacement. Provide sprinkler wrench.

## 2.15 ALARM CHECK VALVE

- A. Provide UL listed check valve.
  1. Variable for City Supplied systems pressure trim set.
  2. Constant for Fire Pump Systems pressure trim set.

## FIRE SPRINKLER SYSTEMS

3. Tyco AV-1, Globe Model H, or approved equal.

## 2.16 SIAMESE FIRE DEPARTMENT CONNECTION

- A. Siamese Wall mounted chrome-plated Siamese. Include caps, sillcock, chain, and a plate lettered AUTO-SPKR.
  1. Provide a 4" X 2-1/2" x 2-1/2".
  2. Potter-Roemer #5751

## PART 3 - EXECUTION

### 3.1 DESIGN

- A. Design, spacing of sprinkler heads and selection sizes shall conform to the requirements of NFPA 13 for the indicated occupancy.
- B. Uniform discharge density design shall be based on hydraulic calculations using the method outlined in NFPA 13. Density of discharge from sprinkler heads shall conform to NFPA 13.
- C. Friction losses in pipe will be based on a value of "C" = 120 in the Hazen and Williams formula.
- D. Design and install the system so that no part will interfere with doors, windows, heating, mechanical, lighting or electrical equipment. Do not locate sprinkler heads closer than 3 feet to lighting fixtures or other obstructions.

### 3.2 LOCATION

- A. Heads shown, if indicated on reflected ceiling plans, are an integral part of the ceiling design. Where heads are not shown or indicated, locate them in the exact center of acoustical ceiling tile unless noted otherwise. In rooms with monolithic plaster or gypsum drywall ceilings, locate the sprinkler heads symmetrically arranged with respect to both axes of the room. Locate sprinkler heads in relation to specialty ceiling elements such as slats, ribs, panels, grids, etc., if not shown on the drawings. Generally, locate heads in the exact center of, or spaced between, such elements. Center heads in corridors.
- B. Locate heads as may be required for coordinated ceiling pattern, even though number of heads exceed minimum code requirements.
- C. Sprinkler heads located in utility or mechanical rooms, penthouses, service corridors, or other such spaces not subject to public view need not be centered in ceiling patterns and may use a straight drop from branch line.

### 3.3 PREPARATION

- A. Ream pipes and tubes, clean off scale, rust, oxide and dirt, inside and outside, before assembly. Remove welding slag or other foreign material from piping.
- B. Pipe beveled each end, per approved procedures.
- C. Hammer clean and flush out piping after welding to remove scale, welding slag and other debris.

### 3.4 CONNECTION

- A. Make screwed joints with square, clean full cut standard taper pipe threads. Ream after cutting and threading. Red lead and linseed oil or other approved non-toxic joint compound applied to male threads only.
- B. Nipples: Shoulder type; extra heavy where less than 1-1/2 inch is unthreaded.
- C. Clamp cast iron water pipe at fittings with 3/4 inch rods and properly anchor and support.
- D. Use grooved mechanical couplings and mechanical fasteners only in accessible locations.

3.5 COORDINATION

- A. Coordinate the installation schedule for this work with the construction schedule for the Work to ensure orderly progress with minimum delay.
- B. Coordinate interface of fire sprinkler system with the work of other trades to ensure proper and adequate provision for the installation and connection of this system.
- C. Coordinate location and quantity of Siamese connections required for fire department connection with Architect and local fire officials.

3.6 SURFACE CONDITIONS

- A. Before starting each stage of the fire sprinkler systems installation, inspect the installed work of other trades and determine that work is complete enough to allow installation to begin. Ensure that work of other trades has been installed in a manner to permit work of this Section in accordance with approved design.

3.7 INSTALLATION

- A. Run piping concealed above furred ceilings and in joists to minimize obstructions. Expose only heads.
- B. Protect sprinkler heads against mechanical injury with heavy duty bolt-on guards.
- C. Locate system drains and inspector's test connections in utility rooms, mechanical rooms or other readily accessible areas not requiring access through ceiling. Coordinate sprinkler system drain flow rates with plumbing system drainage capacities.
- D. Where low points or drains occur above ceilings or in otherwise finished spaces, furnish drain valve with brass cap and chain.
- E. Locate outside alarms on wall of building and coordinate with Architect.
- F. Fire pump and all accessories shall be tested in accordance with NFPA 20 and the local Fire Marshall and/or all other authorities having jurisdiction.
- G. Provide on interior wall near sprinkler valve, cabinet containing extra sprinkler heads of each type and wrench suitable for each head type.
- H. Provide a minimum 18-inch radius swing joint for each drop to sprinkler heads located in ceilings.
- I. Provide Easy-Flex or Flexhead Industries sprinkler hose fittings for each sprinkler head installation for hydraulically designed wet, pre-action, deluge or dry pipe sprinkler connections per NFPA 13. Allow a 3" minimum bend radius per UL.
- J. Install pipe markers to identify fire protection.
- K. Provide shield or deflector for sprinklers or equipment where electrical switchgear, switchboards and motor control centers are in sprinkler protected spaces.
- L. Install valves with stems upright or horizontal, not inverted.
- M. Sprinkler heads shall be installed above and below ductwork over 48 inches wide, in exposed areas, per NFPA 13.
- N. Install the complete fire sprinkler system in accordance with the approved shop drawings.
- O. Perform piping installation in accordance with the provisions of the specifications, including furnishing of required sleeves for fire sprinkler system pipes passing through rated walls, floors, and other parts of the building. Provide scheduled 40 galvanized pipe sleeve for concrete or CMU

FIRE SPRINKLER SYSTEMS

penetrations. Furnish size required for fireproofing and or insulation. Furnish and install split wall plates and chrome plated escutcheons for exposed fire sprinkler system pipes. Where pipes pass through concrete floors, furnish and install wrought iron or steel pipe sleeves made flush with the ceiling below and extending 2" above the finished floor.

- P. Do not cut or make holes in any part of the building except where shown on the approved shop drawings.
- Q. Furnish and install, next to the sprinkler riser main, a print sheet protected by glass or a transparent plastic cover, giving brief instructions regarding control, emergency procedure, and other data required by NFPA #13. For hydraulically designed sprinkler systems, a placard is to be permanently attached to the riser indicating the location, and the basis of design (discharge density and system demand).
- R. Do not install exposed piping below structure in public area.
- S. Provide heat tracing and insulation on wet piping systems exposed to freezing when not installed in a heated space or installed by other acceptable methods of maintaining the piping from freezing. Installation of heat tracing and insulation shall be in accordance with the latest edition of NFPA 13 and the local code authorities. Coordinate electrical requirements with Division 26.

### 3.8 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved adjustable ring type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved adjustable ring type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed.
- D. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Steel Max. Support Spacing, Feet	Minimum Rod Diameter, Inches
1" & smaller	6	3/8
1-1/4" & 1-1/2"	8	3/8
2"	10	3/8
3"	10	1/2
4" & 5"	10	5/8
6" and above	10	3/4

### 3.9 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable ring type hangers shall be used for single pipe supports; Erico Model 115 NFPA UL/FM. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. All parts shall be zinc plated carbon steel, or galvanized.

### 3.10 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:

## FIRE SPRINKLER SYSTEMS

1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
  2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and airtight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

### 3.11 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

### 3.12 FLUSHING AND TESTING

- A. Testing and flushing of installation of sprinkler system shall be in accordance with NFPA 13, and NFPA 25.
- B. Flush sprinkler piping in accordance with NFPA 13. Additionally, flush all alarm valves, and all main piping up to valve.
- C. In addition to NFPA 13 required tests, provide flow switch test and tamper switch test for each device, and verify alarm valve operation.
- D. All tests shall be witnessed by Architect / Engineer. Contractor shall notify Architect / Engineer 7 working days in advance.

### 3.13 EXCAVATING, TRENCHING, AND BACKFILLING

- A. Perform excavation, trenching, and backfilling for this portion of the work in accordance with the specifications.

### 3.14 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.

## FIRE SPRINKLER SYSTEMS

- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
  - 1. Both sides of penetrations through walls, floors and ceilings.
  - 2. Close to valves or flanges.
  - 3. Intervals on straight pipe runs not to exceed 50 feet
  - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

### 3.15 TESTING AND ACCEPTANCE

- A. Prior to connecting to the overhead sprinkler piping, flush the underground main. Secure required approvals of the flushing operations.
- B. Upon completion of the fire sprinkler system installation, test and retest the complete installation and make corrections as necessary to obtain acceptance by the Fire Marshall and/or any other authority having jurisdiction. Furnish test equipment and personnel required.

### 3.16 TRAINING

- A. At a time mutually agreed upon, provide 4 hours of instruction to the Owner's designated personnel on the operation and maintenance of the automatic sprinkler system and associated equipment. Owner's Operation and Maintenance Manual prepared for this project shall be used during the instruction.

END OF SECTION



SECTION 22 01 00

PLUMBING OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element.
  - 2. Contractor information.
  - 3. All submittals, coordination drawings and product data, reviewed by the Architect / Engineer; bearing the Architect / Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
  - 4. All parts and maintenance manuals for items of equipment.
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates).
  - 9. Control operations/equipment wiring diagrams.
  - 10. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect / Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1 inch; Maximum ring size: 3 inches.
- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

PART 3 - EXECUTION

PLUMBING OPERATING AND MAINTENANCE MANUALS

### 3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
  - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
  - 2. Format:
    - a. Size: 8-1/2 inch x 11 inch.
    - b. Text: Manufacturer's printed data or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable.
    - c. Identity of general subject matter covered in the manual.
  - 6. Binder as specified.
- B. Content of Manual:
  - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number.
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer.
      - 2) Maintenance contractor as appropriate.
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement.
    - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  - 2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
  - 3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems.
      - 2) Control and flow diagrams.
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  - 4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  - 5. Copy of each warranty, bond and service contract issued.
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure.
      - 2) Instances that might affect validity of warranties or bonds.
  - 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
  - 1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts.
      - 1) Function, normal operating characteristics, and limiting conditions.
      - 2) Performance curves, engineering data and tests.
      - 3) Complete nomenclature and commercial number of replaceable parts.
    - b. Operating procedures:
      - 1) Start up, break-in, routine and normal operating instructions.

- 2) Regulation, control, stopping, shut down and emergency instructions.
    - 3) Summer and winter operating instructions.
    - 4) Special operating instructions.
  - c. Maintenance procedures:
    - 1) Routine operations
    - 2) Guide to trouble-shooting.
    - 3) Disassembly, repair and reassembly.
    - 4) Alignment, adjusting and checking.
    - 5) Routine service based on operating hours.
  - d. Servicing and lubrication schedule. List of lubricants required.
  - e. Manufacturer's printed operating and maintenance instructions.
  - f. Description of sequence of operation by control manufacturer.
  - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - 1) Predicted life of part subject to wear.
    - 2) Items recommended to be stocked as spare parts.
  - h. As installed control diagrams by controls manufacturer.
  - i. Complete equipment internal wiring diagrams.
  - j. Each Contractor's coordination drawings.
  - k. As installed color coded piping diagrams.
  - l. Charts of valve tag number, with location and function of each valve.
  - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
  - n. Other data as required under pertinent sections of the specifications.
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
  4. Provide complete information for products specified in Division 22.
  5. Provide certificates of compliance as specified in each related section.
  6. Provide start up reports as specified in each related section.
  7. Provide signed receipts for spare parts and material.
  8. Provide training report and certificates.
  9. Provide backflow preventer certified test reports.
  10. Provide gas piping pressure test reports.

END OF SECTION

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SECTION 22 05 00

PLUMBING GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 22 Plumbing.
- B. Applicable provisions of this section apply to all sections of Division 22, Plumbing.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Plumbing work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department
  - 5. Texas Department of Licensing & Regulations (TDLR)
  - 6. Texas Accessibility Standards (TAS Based on ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A licensed specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
  - 2. Able to furnish evidence of having contracted for and installed not less than three systems of comparable size and type that has served their Owners satisfactorily for not less than three years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions

PLUMBING GENERAL PROVISIONS

of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain three sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (two sets are for the Owner's use and one set is for the Architect / Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2012 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's seal, name, address and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
  - 6. Indicate exact location of all underground plumbing and flow line elevation.
  - 7. Indicate exact location of all underground plumbing piping and elevation.
  - 8. Indicate exact location of all underground electrical raceways and elevations.
  - 9. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 10. During the execution of work, maintain a complete set of drawings and specifications upon which all locations of equipment, ductwork, piping, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 11. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and plumbing valves.
  - 12. Exact location of all electrical equipment in and outside of the building.
  - 13. Fire Protection System documents revised to indicate exact location of all sprinkler heads and zone valves.
  - 14. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 15. Cloud all changes.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items.

#### 1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

1.10 GUARANTEE

- A. Guarantee work for one year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 22 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all plumbing systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit three copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit three copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each subcontractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other

divisions. Drawings and layout work for exact size and location of all openings are included under this division.

### 3.2 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted plumbing equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
  - 1. 4 inch high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Doweled to existing slab
- D. Install concrete curbs around multiple pipe penetrations.

### 3.3 VANDAL RESISTANT DEVICES

- A. Provide a handle for each loose keyed operated valve and hose bibb on the project.
- B. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner two suitable tools for use with each type of fastener used.
- C. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

### 3.4 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the plumbing systems.
  - 1. Provide the training during the Owner's regular working day.
  - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building plumbing systems and with the project.
- B. Time to be allocated for instructions.
  - 1. Minimum of 8 hours dedicated instructor time.
  - 2. 4 hours on each of 2 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
  - 1. One copy to the Owner.
  - 2. One copy to the Architect / Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.



- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.5 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
  - 1. Designation approved by Architect / Engineer.
  - 2. Equipment includes, but is not limited to, water heaters, pumps, boilers and utility controllers.
  - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with ½ inch high letters and fastened with epoxy or screws.

### 3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.7 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

END OF SECTION

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SECTION 22 05 10

PLUMBING CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION

SECTION 22 05 12

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1.
- B. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- C. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4 inch = 1 foot - 0 inch.
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
  - 1. Actual mechanical equipment and components to be furnished
  - 2. Service clearance
  - 3. Relationship to other equipment and components
  - 4. Roof drains and leader piping
  - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
  - 1. Ductwork shop drawings
  - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

PLUMBING SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply, "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect/Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect/Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect/engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
  - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name and address
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
  - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
  - 2. Associated items which require correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a re-submittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions,

field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT/ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect/Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule
  - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect/Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED.

PART 3 - EXECUTION - NOT USED

END OF SECTION



SECTION 22 05 13

ELECTRICAL PROVISIONS OF PLUMBING WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as plumbing work are indicated in other Division 22 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as plumbing, specified or partially specified in this Section, include but are not necessarily limited to the following:
  - 1. Motors for plumbing equipment.
  - 2. Starters for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 3. Wiring from motors to disconnect switches or junction boxes for motors of plumbing equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 4. Wiring of field-mounted float control switches, flow control switches, and similar plumbing-electrical devices provided for plumbing systems, to equipment control panels.
  - 5. Pipe heat tracing.
- C. Refer to Division 22 sections for specific individual plumbing equipment electrical requirements.
- F. Refer to Division 26 sections for motor starters and controls not furnished integrally with plumbing equipment.
- G. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of plumbing equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of plumbing work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

PART 2 - PRODUCTS

2.1 MOTORS

- A. Provide motors for plumbing equipment manufactured by one of the following:
  - 1. Baldor Electric Company.
  - 2. Century Electric Div., Inc.
  - 3. General Electric Co.
  - 4. Louis Allis Div.; Litton Industrial Products, Inc.
  - 5. Lincoln Electric
  - 6. Marathon Electric Mfg. Corp.
  - 7. Reliance Electric Co.
  - 8. Westinghouse Electric Corp.

ELECTRICAL PROVISIONS OF PLUMBING WORK

- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of plumbing equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of plumbing work:
- C. Temperature Rating. Rated for 40 deg. C environment with maximum 50 deg. C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for  $\frac{3}{4}$  hp and larger, and provide capacitor-start single-phase motors for  $\frac{1}{2}$  hp and smaller, except  $\frac{1}{6}$  hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 22 requirements. For 2-speed motors provide two separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
  - 1. Frames. NEMA #56.
  - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 22 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
  - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 22 for other enclosure requirements.
  - 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
  - 5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.

## 2.2 EQUIPMENT FABRICATION

- A. Fabricate plumbing equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in plumbing work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

SECTION 22 05 14

PLUMBING ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to

field verify existing sanitary / grease waste connections. Verify flow direction and depth prior to connection to existing plumbing systems.

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

### 3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping and connections to maintain existing systems in service during construction.
- C. Existing Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Plumbing systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping coincident with the construction.
- G. Remove or relocate existing piping or housekeeping pads as occasioned by new or remodeled construction. Cap unused domestic piping beyond the new finish line.
- H. Relocate all domestic piping as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.
- J. Remove all known utilities that do not provide service to the buildings that remain.

- K. Remove existing plumbing vent penetrations through roof not to be reused.

#### 3.4 DEMOLITION AND EXTENSION OF EXISTING PLUMBING WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Plumbing, piping and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing plumbing installations, or as specified.
- H. Existing plumbing piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

#### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

#### 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing plumbing equipment in renovated areas as specified in Section 22 05

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END OF SECTION

SECTION 22 05 17

PLUMBING ACCESS DOORS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install access doors in wall or ceiling locations as required or shown for access to valves, controls, regulating devices, water arresters and other equipment requiring maintenance, adjustment or operation.

PART 2 - PRODUCTS

2.1 NON-FIRE RATED ACCESS DOORS

- A. 16-Gauge frames
- B. 14-gauge steel panels
- C. Continuous fully concealed hinges
- D. Flush screwdriver cam lock & cylinder lock for Owner selection
- E. Prime coat finish
- F. Brushed satin stainless steel finish for restroom, kitchen or cafeteria installation
- G. Material suitable for wall and/or ceiling mounting

2.2 FIRE RATED ACCESS DOORS

- A. UL listed, 1-1/2 hour Label "B", access doors
- B. 16-Gauge stainless steel
- C. 20-Gauge insulated sandwich-type door panel.
- D. Two inch thick with fire rated insulation
- E. Continuous fully concealed hinge
- F. Automatic closing and latching mechanism
- G. Knurled knob and recessed key operation for Owner selection
- H. Interior latch release slide for opening from inside
- I. Prime coat finish
- J. Material suitable for wall and/or ceiling mounting

2.3 ACCEPTABLE MANUFACTURERS

- A. Milcor
- B. MIFAB
- C. Acudor
- D. Elmdor

PLUMBING ACCESS DOORS

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Access doors specified in Division 22 will be installed by other crafts. Not all required access doors are shown. Coordinate with the Contractor to locate access doors for ease of operation and maintenance of concealed equipment.
- B. Installation shall be in accordance with the manufacturer's printed instructions.
- C. Minimum size required:
  - 1. 24 inch x 24 inch for plumbing multiple isolation valves and electrical related items in ceilings
  - 2. 8 inch x 8 inch for plumbing for single isolation valve or shock arrestor

END OF SECTION



SECTION 22 05 23

VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Plumbing Valves
- B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
  - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450 deg. F.
  - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
- B. Butterfly Valves
  - 1. Butterfly valves shall conform to MSS-SP67.
  - 2. Liners, inserts and discs shall be suitable for the intended service.
  - 3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
  - 4. All valves for domestic use must be lead free.
- C. Balancing Valves
  - 1. Provide balancing valves with:
    - a. Corrosion resistant plug with resilient seal when required.
    - b. O-ring stem seal.
    - c. Permanently lubricated, corrosion resistant bearings.
  - 2. Connections
    - a. Through 2 inch pipe size use threaded connections.
    - b. For valves 2-1/2 inch pipe size and larger shall be provided with 150 psig flange connections.
  - 3. Provide each valve with:
    - a. Memory stop.
    - b. Plastic drip cap.
    - c. 1/8 inch gauge tap.
  - 4. All valves for domestic use must be lead free.
- D. Ball Valves
  - 1. Provide ball valves with:
    - a. Blowout proof stem.
    - b. Full size port, 316 stainless steel ball and stem.
    - c. Cast bronze body.
    - d. Threaded ends.
  - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
  - 3. Service rating:
    - a. 150 psi saturated steam.
    - b. 600 psi WOG.
  - 4. Provide with memory stop for balancing valves.
  - 5. Where Viega ProPress fittings are used, Viega ProPress ball valves may be used.
  - 6. All valves for domestic use must be lead free.
- E. Valve Connections
  - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
  - 2. Thread pipe sizes 2 inches and smaller.
  - 3. Flange pipe sizes 2-1/2 inches and larger.

VALVES, STRAINERS AND VENTS

4. Use screw to solder adapters for copper tubing.
  5. Use grooved body valves with mechanical grooved jointed piping.
  6. Use press valves when using copper press systems.
- F. Valve Operators
1. Provide suitable hand-wheels for gate, globe, angle or drain valves and inside hose bibbs.
  2. When cocks and valves are furnished with square head stem:
    - a. Provide one wrench for every ten cocks or valves sized 2 inches and smaller, minimum of two.
    - b. Provide each cock or valve size 2-1/2 inches and larger with a wrench with setscrew.
  3. Where butterfly valves are provided:
    - a. Provide gear operators on valves 6 inches and larger.
    - b. Where valves are located 7 feet or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5 feet above floor and hook to clips, arrange to clear walking space.
    - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4 inches and smaller.
- G. Acceptable Manufacturers (All listed must be lead free):
1. Apollo
  2. Crane
  3. Dezurik
  4. Jenkins
  5. Keystone
  6. Kitz
  7. Milwaukee Valve
  8. Nibco
  9. Stockham
- H. Check Valves
1. Bronze body, 2 inches and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection (Lead Free).
  2. Iron body, 2-1/2 inches and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug (Lead Free).
  3. Acceptable Manufacturers (All listed must be lead free):
    - a. Apollo
    - b. Keystone
    - c. Kitz
    - d. Milwaukee
    - e. Mission Duocheck
    - f. Nibco
- I. Backflow Preventer (All valves for domestic use must be lead free):
1. BFP-1 (2 inches and smaller) bronze body, reduced pressure zone type with two inline independent check valves with an intermediate relief valve, complete with two full port ball valve shut-offs and ball type test cocks. Bronze strainer on inlet. Provide air gap fitting with full size drain piped to nearest floor drain. Watts 909-QT-S-LF.
  2. BFP-2 (2-1/2 inches and larger) stainless steel or FDA epoxy coated ductile iron reduced pressure zone type with two inline independent check valves with reverse relief valves, two non-rising stem resilient sealed gate valves, cast iron strainer on inlet. Provide air gap fitting piped full size to nearest floor drain. Apollo RP4ALF-YS or Watts 909-NRS-BB-S-LF.
- J. Provide valves of same manufacturer throughout where possible.
- K. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.
- L. Where valves are installed in insulated piping, provide with extended neck so valve operator and

stop plate clears the full thickness insulation.

- M. Provide valve, seat and trim materials suitable for the intended service.
- N. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, globe or ball type.

## 2.2 PIPE SYSTEMS STRAINERS

- A. Body:
  - 1. Bronze "Y" pattern or basket as shown on the drawings.
  - 2. Line size.
  - 3. Threaded strainer blow down port.
  - 4. ASTM A #126 Class B Cast Iron Body.
- B. Construction:
  - 1. 2 inch size and smaller with screw connections rated 400 psi WOG.
  - 2. Over 2 inch size with flanged connections, rated 125 psi WOG.
- C. Fabricate screens of Monel or type 304 stainless steel:
  - 1. With 20 mesh woven wire in piping systems through 2 inches.
  - 2. With 0.045 perforations in piping systems 2-1/2 inches and 3 inches.
  - 3. With 0.125 perforations in piping systems 4 inches and larger.
- D. Start-up:
  - 1. Provide an additional fine mesh disposable screen for use during start-up operations.
  - 2. Remove after 30 days.
  - 3. Attach to piping for Owner's review.
- E. Acceptable Manufacturers (All listed must be lead free):
  - 1. Apollo
  - 2. Crane
  - 3. Keckley
  - 4. Kitz
  - 5. Mueller
  - 6. McAlear
  - 7. Muesco
  - 8. Nibco
  - 9. Zurn

## 2.3 VALVE SCHEDULE

- A. Domestic Service
  - 1. Gas shut-off service: UL approved for natural gas service.
    - a. Nibco Ball Valve, full port through 1 inch: T-585-70-UL
    - b. Nibco Ball Valve conventional port 1-1/4 inch through 3 inch: T-580-70-UL
    - c. Resun 2-1/2 inch and larger: 143 - 1-UL
    - d. DeZurick 2-1/2 inch and larger: Series 425 or 435
    - e. Locking Type: Rockford 3/4 inch and 1 inch PNP-400  
Mueller 1-1/4 inch through 4 inch: Lub-O-seal
    - f. Conbraco Ball Valve, full port through 4 inch: 64-100 Series
    - h. Milwaukee Full Port 1/4 inch-2 inch
    - i. Milwaukee Standard Port 2-1/2 inch & 3 inch
    - j. Kitz Full Port 2 inch =- #68
  - 2. Cold and Hot water service (all listed must be Lead Free):
    - a. Nibco Ball Valve full port through 2 inch: T-585-66-LF
    - b. Nibco Ball Valve 2-1/2 inch and 3 inch conventional port: T-580-66-LF
    - c. Nibco Butterfly Valve 4 inch and larger: LD-2000 EDPM Gaskets
    - d. Watts Ball Valve 4 inch and larger: G-4000-FDA
    - e. Viega ProPress Bronze Ball Valves (where Viega ProPress fittings are used)
    - f. Kitz Full Port through 2 inch - #868M Lead Free
    - h. Milwaukee Full Port 1/4 inch-2 inch
    - i. Milwaukee Standard Port 2-1/2 inch & 3 inch

## VALVES, STRAINERS AND VENTS

- j. Apollo Ball Valve Full Port through 2-1/2 inch 77CALF
- k. Apollo Ball Valve Standard Port 3 inch 70LF
- l. Apollo Butterfly Valve 4 inch and Larger LD141
- m. Apollo Press Bronze Ball valves – 77 WLF
- 3. Check Valve (All listed must be Lead Free):
  - a. Nibco Check Valve: T - 413 - Y -LF (Teflon Seats)
  - b. Nibco Check Valve 2-1/2 inch and larger: F - 918 – Y -LF (Buna-N disc.)
  - c. Nibco Check Valve 2-1/2 inch and larger: W - 920 -W-LF (Wafer)
  - d. Kitz Y & Check: A-22T
  - e. Kitz 2-1/2 inch and Larger #778 C.I.
  - f. Kitz Wafer Check 2-1/2 inch and Larger #7032
  - g. Milwaukee Valve – 509T
  - h. Apollo Check Valve: 163TLF
  - i. Apollo Check Valve 2-1/2 inch and larger: 910FLF
  - j. Apollo Press Check Valve: 163TPR-LF
  - k. Apollo Check Valve 2 inch and larger 910WE-LF (Wafer)

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in domestic hot water and domestic cold water systems interchangeable in place of gate and globe valves.
- D. Use butterfly valves and ball valves in circulating water systems, for balancing duty.
- E. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
  - 1. 1 inch valve for pipes 6 inch and larger.
  - 2. 3/4 inch valve for pipes smaller than 6 inch.
  - 3. Terminate with pipe plug.
  - 4. Drain valves shall be ball valves.
- F. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on the drawings.
- G. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- H. Provide clearance for installation of insulation and access to valves.
- I. Provide access where valves are not exposed.

#### 3.2 VALVE TAGS

- A. Furnish valves with 1-1/2 inch diameter brass valve tags with stamped, black or red-filled numbers. Service designations shall be 1/4 inch letters, and valve numbers shall be 2 inch letters. Engineer shall approve Service designations. Secure tags to valves by use of brass "S" hooks or brass chain. Secure chain to valve by use of copper or Monel meter seals. Valve tags are not required if the valve is located within 3 feet of the equipment being served and the service is obvious.
- B. Mount charts and drawings listing functions of each valve and its location in a metal and glass frame. Place charts and drawings as directed; in addition, on the record drawings mark the symbols and furnish a valve schedule properly identifying the valve number, service, exact location, the material being piped, and the room number of area that the valve services. This schedule shall be furnished on reproducible drafting paper or film suitable for reproduction on an Ozalid machine. The Owner shall approve the size of drafting paper. Provide a copy of the valve

chart in the Operating and Maintenance Manuals.

### 3.3 PIPE SYSTEMS STRAINERS

- A. Provide strainers in supply piping to circulating pumps, thermostatic mixing valves, before solenoid valves and trap primer valves.

END OF SECTION

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SECTION 22 07 19

PLUMBING PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including domestic hot and cold water, roof and overflow drain sump bodies and rain leaders, horizontal sanitary drain piping which receives condensate, make-up water and pool heating water.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 APPROVALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Glass fiber pipe insulation:
  - 1. Johns-Manville Micro-Lok AP-T
  - 2. Owens-Corning ASJ/SSL
  - 3. Knauf ASJ/SSL

PLUMBING PIPING INSULATION

- B. Cellular Glass Insulation (Foamglass):
  - 1. Pittsburg Corning
  - 2. Cell-U-Foam
- C. Aluminum Jacketing:
  - 1. Childers
  - 2. Pabco
  - 3. RPR
- D. Fiberglass reinforcing cloth mesh:
  - 1. Perma Glass Mesh
  - 2. Alpha Glass Mesh
  - 3. Childers Chil-Glas
  - 4. Vimasco
- E. Mastics and Adhesives
  - 1. Childers
  - 2. Foster
  - 3. Vimasco
  - 4. Armstrong 520 Adhesive
- F. Elastomeric Insulation
  - 1. Armacell
- G. Weather Resistant Coating
  - 1. WB Armaflex Finish
- H. Glass fiber blanket insulation
  - 1. Manville R-series Microlite FSKL
  - 2. Owens-Corning eD75 or ED100 RKF
  - 3. Knauf 0.75 PCF FSK

## 2.2 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
  - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

## 2.3 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than 3/4" shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test. Minimum 3/4" thick.
  - 1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

## 2.4 CELLULAR GLASS INSULATION

- A. ASTM C552:
  - 1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);
  - 2. 8.0 lb./cu.ft. (128 kg/cu.m.) density

## 2.5 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to



insulation so that metal will not slide with respect to insulation with ½" aluminum bands (2) per shield.

1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.
  2. Minimum thickness of foam glass insulation shall not be less than 1" thick.
- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

## 2.6 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 adhesive.
- B. Vapor Barrier Finish:
1. Indoors: Provide as insulation coating Childers CP-35, white.
  2. Outdoors: Provide as insulation coating Childers Encacel X.
  3. Underground: Provide Childers CP-22/24 for fittings and areas. Pittwrap cannot be used.
- C. Sealant. Provide Childers CP-76 vapor barrier sealant.
- D. Lagging Adhesive. Provide Childers CP-50.
- E. Other products of equal quality will be acceptable only upon approval.

## 2.7 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier. Childers Lock-On or approved equal.
- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.
- C. Straps and Seals. Provide ½" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

## 2.8 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

## PART 3 - EXECUTION

### 3.1 INTERIOR PIPING

- A. Cover all piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-35 vapor barrier coating for chilled water piping applications.
- B. Install hanger with protective shield, on the outside of all insulation.
- C. Where domestic water pipes (1/2" & ¾" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- D. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.

- E. Seal ends of pipe for drinking chilled water insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.
- F. Apply a smooth flood coat of white lagging Foster 8142W over all exposed insulation.
- G. Piping to be insulated as specified above:
  - 1. All hot and cold water.
  - 2. Make-up water
  - 3. Horizontal sanitary drain piping that receives condensate
  - 4. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body and all horizontal rain leaders to first elbow turning down

### 3.2 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with 1/2" wide glass filament tape.
- D. Apply a tack coat of fitting mastic over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
- F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

### 3.3 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
  - 1. Apply a tack coat of insulating mastic to the insulated fitting to produce a smooth surface.
  - 2. After mastic is dry, apply a second coat of vapor barrier mastic. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
  - 3. Overlap mastic and fiberglass cloth by 2" on adjoining sections of pipe insulation.
  - 4. Apply a second coat of mastic over the fiberglass cloth to present a smooth surface.
  - 5. Apply mastic to a wet film thickness of 3/64".
  - 6. Fabric shall not be visible after completion.
  - 7. Vapor seal flanges, valves and fittings with Childers CP-35.
- B. PVC fitting covers are not acceptable.

### 3.4 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

- A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.
- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal.

- C. Install straps on 9" centers and at each circumferential lap joint.
- D. Cover and seal all exposed surfaces.
- E. The use of screws and rivets is not approved.
- F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

3.5 CONCEALED STORM DRAIN PIPING

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing. Install insulation of clean, dry piping.
- B. Insulation shall be wrapped tightly on the piping with all circumferential joints and longitudinal joints overlapped a minimum of 2" with facing to the outside to obtain specified R-value using a maximum of 25% compression.
- C. Provide vapor retarder at penetrations, joints, seams and damage to the facing with staples and FSK foil tape. The facing shall be taped with a minimum 3" wide strip of reinforced foil tape. Pressure-sensitive tape shall be a minimum 3" (76mm) wide and shall be applied with moving pressure using an appropriate sealing tool. Staples shall be outward cinch and placed 6" (152mm) on center.
- D. Mechanical / Electrical rooms and above ceilings are considered concealed spaces.

3.6 MISCELLANEOUS

- A. Install materials after piping has been tested and approved.
- B. Apply insulation on clean, dry surfaces only.
- C. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

3.7 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS</u> <u>(Inches)</u>
Exposed Roof Drain Bodies and Horizontal Roof Drain Leaders	1
Exposed Roof Overflow Drain Bodies and Horizontal Drain Leaders	1
Domestic Cold Water/Make-Up Water Piping/Drinking Chilled Water	1
Horizontal Sanitary Drain Piping Which Receives Condensate	1
Domestic Hot Water Piping, 1-1/2" Pipe and Smaller	1
Domestic Hot Water Piping, 2" Pipe and Larger	1-1/2

END OF SECTION

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SECTION 22 11 16

DOMESTIC WATER PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install domestic hot and cold water piping.

1.2 RELATED WORK

- A. Division 22 Plumbing
1. Valves, Strainers and Vents
  2. Pipe and Pipe Fittings - General
  3. Plumbing Piping Insulation
  4. Plumbing Fixtures and Fixture Carriers

PART 2 - PRODUCTS

2.1 PIPING AND FITTINGS

- A. Below Slab on Grade Piping for Water Entries:
1. 2-inch and smaller, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube. No joints below slab entries.
  2. 2-1/2-inch and 3-inch, provide ASTM B88 Type K (heavy wall) annealed tempered (soft) seamless copper water tube, 20 ft. straight lengths. One joint allowed below slab entry using wrought copper, solder-joint pressure fittings: ASME B16.22 with an approved brazing filler metal or pipe can be shop bent for no joint installation by using a "bending" temper tubing.
  3. 4-inch and larger, provide ductile iron pipe with mechanical joints, ANSI A21.6.
  4. 3 inch and larger, provide one-piece stainless steel IBR (in building riser), Watts or Ames.
- B. Below Grade Piping Outside Building (beyond 5'-0" of building): Provide PVC water main pipe 4 inch through 12 inch in diameter in conformance with AWWA C900. When using 3" or smaller provide Schedule 40 PVC ASTM D1785 with ASTM D-2466 socket type fittings. Provide fittings in conformance with ASTM 2466. Furnish pipe with a minimum pressure rating of 150 lbs. per square inch. Provide PVC pipe as manufactured by Johns-Manville, CertainTeed, Clow or approved equal.
- C. Below Slab on Grade Piping. Furnish ASTM B 88 and ANSI/NSF Standard 61 annealed tempered (soft), Type K copper water tube. Run continuous with no joints under the floor slab. Provide copper pipe corrosion protection as specified in this Section.
- D. Above Slab Piping. Provide seamless ASTM B 88 and ANSI/NSF Standard 61 drawn tempered (hard) Type L copper water tube with wrought copper or bronze fittings with solder-joints, ANSI B16.22. Solder material shall be 95-5 (lead free) (Tin-Antimony-Grade 95TA) ASTM B 32.
- E. Unions. Provide 150 lb. standard unions with ground joint and bronze seat. Flange joints larger than 2 inches. Provide dielectric isolating unions at junctions or connection between metallic piping of dissimilar metal. Provide pipe threads with standard taper pipe threads ANSI B2.1.
- F. Alternate Method of Joining Copper Pipe and Tubing: Press Fittings: Copper press fitting shall conform to the material and sizing requirements of ASME B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

2.2 WATER HAMMER ARRESTORS

- A. Provide piston type hydraulic engineered/manufactured water hammer arrestors in cold and hot water supply lines in chases or walls to each fixture branch or battery of fixtures serving quick closing valves of electrical, pneumatic, spring loaded type, or quick hand closure valves on fixture

DOMESTIC WATER PIPING AND APPURTENANCES

trim. Provide water hammer arrestors at the end of the branch line between the last two fixtures served. Provide Precision Plumbing Products, Inc., or equal. Size units according to water hammer arrestor's Standard PDI WH-201; refer to schedule on drawings.

- B. Install all water hammer arrestors so as to attain 100% effectiveness according to Plumbing and Drainage Institute PDI-WH201 Table 5, 6 and 6-A for water hammer arrestors.
- C. All water hammer arrestors shall be installed in a vertical position.
- D. All water hammer arrestors shall be accessible and shall have access panels where required. Arrestors located above ceilings in fixture drops will not be acceptable. Refer to sizing and placement data as indicated in PDI Standard PDI-WH-201.

### PART 3 - EXECUTION

#### 3.1 DRAINAGE

- A. Install water piping systems with uniform horizontal grade of 1/8 inch per 10 foot, minimum, to low points to provide complete system drainage. Where constant pitch cannot be maintained for long runs, establish intermediate low points and rise to new level. Grade branches to drain to mains or risers. Unless otherwise indicated, terminate low points of risers with drain valve piped to nearest hub or floor drain.

#### 3.2 STERILIZATION

- A. Sterilize the water system with solution containing not less than 50PPM available chlorine. Allow chlorinating solution to remain in system for period of 8 hours (minimum). Have valves and faucets opened and closed several times during the period. After sterilization, flush the solution from the system with clean water until residual chlorine content is less than 0.2 parts per million.
- B. Submit for approval to the Architect/Engineer a copy of the laboratory report and the certification of performance. An approved copy of each document shall be inserted in the Owner's manual.

#### 3.3 UNDERGROUND WATER PIPING SYSTEM PROCEDURES

- A. Lay sewer and water lines in separate trenches, separated by 10 foot of undisturbed or compacted soil.

#### 3.4 PRESSURE TESTING

- A. Test under a cold water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Test the domestic water piping system at 150psig hydrostatic pressure, maintained for 6 hours.
- C. Use only potable water for the test.
- D. Perform the test before fixtures, faucets, trim or final connections are made to equipment.
- E. If the system is tested in sections, the entire domestic water piping system shall be submitted to a final test, employing the specified procedure.
- F. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- G. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- H. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

#### 3.5 COPPER PIPE CORROSION PROTECTION

- A. Corrosion protect copper tube piping systems:

### DOMESTIC WATER PIPING AND APPURTENANCES

1. In the building slab.
  2. Beneath the building slab.
  3. Buried.
  4. Route plasti-sleeve 0.006 thick material entire length of below slab on grade copper tubing.
- B. Cover copper tubing piping system with:
1. "Tapecoat" TC Primer.
  2. "Tapecoat" CT cold applied coating tape.
- C. Install coating system as specified by the manufacturer.
- D. Extend the corrosion protection 2 inches above concrete slab on grade.

3.6 TEST OF PIPE CORROSION PROTECTION SYSTEM

- A. Test the pipe corrosion protection coating with an approved high voltage tester adjusted to provide sufficient voltage to produce a spark through a pinhole in the coating (at least 15 kv AC).
- B. Make repairs to small holes in accordance with the manufacturer's instructions.
- C. Retest the repairs using procedures listed above.
- D. Furnish certificate of compliance with field testing in Owner's manual.

END OF SECTION

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SECTION 22 13 16

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping in buildings and underground laterals to 5 foot outside of building.

1.2 RELATED WORK

- A. Site Work:
1. Sanitary Sewers
  2. Excavation, Trenching and Backfilling for Utilities
- B. Division 22 Plumbing:
1. Pipe and Pipe Fittings
  2. Plumbing Fixtures and Fixture Carriers
  3. Drains, Cleanouts and Hydrants
  4. Earthwork

1.3 REFERENCES

- A. CISPI - Cast Iron Soil Pipe Institute
- B. ASTM - American Society for Testing and Materials

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. All No-Hub clamps must have 4 bands minimum. Sizes 5" through 10" shall have six bands minimum.
1. No-Hub Clamps – Sanitary Waste:
    - a. Husky SD 4000
  2. No-Hub Clamps - Vents
    - a. Husky SD – 2000
    - b. Mission Rubber Co., LLC Heavy Weight Couplings
  3. Clamp-All Hi-TorQ 80 or approved equal
- B. Provide Fernco "Pro-flex" shielded couplings Series 3000 with one piece neoprene gasket for all cast iron pipe transitions to Schedule 40 DWV pipe penetrations through slabs. Sizes 1-1/2" through 8" Series 3000.
- C. Cast Iron Soil Pipe and Fittings:
1. AB&I
  2. Charlotte Pipe and Foundry Co.
  3. Tyler Pipe / Soil Division

2.2 DRAIN PIPE AND FITTINGS

- A. Above Slab Pipe:
1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
  2. Pipe shall conform to ASTM A74.
  3. No-hub couplings shall meet or exceed the latest specification standard CISPI 310 or ASTM C-1540 and conform to FM 1640. CISPI 310 Couplings shall be listed by NSF International.
  4. Rubber Gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
  5. All Cast Iron Soil Pipe and Fittings shall be marked with the collective trademark of the Cast Iron Soil Pipe Institute
- B. Below Slab on Grade Piping:

SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

1. Schedule 40 PVC plastic pipe and DWV fittings.
2. Solvent welded DWV joints shall conform to IAPMO Installation Standard IS-9.
3. Pipe and fittings shall conform to ASTM D 1784, ASTM D 1785, ASTM D 2665, ASTM D 3311 and NPS Standard 14 & 61.

## 2.3 VENT PIPE AND FITTINGS

- A. Above Slab Pipe:
  1. No-hub cast iron soil pipe and fittings shall conform to CISPI 301 and ASTM A888.
  2. Pipe shall conform to ASTM A74.
  3. No-hub couplings shall conform to CISPI 310 and shall be listed by NSF International
  4. Rubber gaskets for cast iron soil pipe and fittings shall conform to ASTM C564
- B. Below Slab on Grade Piping:
  1. Provide Schedule 40 PVC with DWV fittings with solvent welded joints. Pipe and fittings shall conform to ASTM D1784-82.
- C. Above Slab Pipe.
  1. Drainage-waste-vent copper pipe and fittings for waste stub-outs for all fixture locations.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. All above and below slab soil, waste, sanitary drain and vent piping installation methods shall be in accordance with Cast Iron Soil Pipe Institute Standards.
- B. Above ground installation in the horizontal position shall be supported at every hub (hub & spigot or hubless type). Hangers are to be placed within 18" of hub or coupling. For large diameter fittings, 5 inches and larger shall be braced to prevent horizontal movement. Every branch opening or change of direction, braces, blocks, rodding or other suitable method shall be used to prevent movement. Riser clamps to be used for each floor, not to exceed 15'-0".
- C. All above and below slab PVC sanitary waste and vent piping installation methods shall be in accordance with IAPMO Installation Standard 18-9 for Schedule 40 PVC-DWV, per manufacturer's recommendations and applicable standards.
- D. Tracer wires shall be installed on all underground PVC sanitary sewer lines installed outside the building slab.
- E. All PVC underground shall be installed in accordance with ASTM D2321.

### 3.2 GRADE

- A. Give horizontal pipe grade of 1/4-inch per foot where possible, but not less than 1/8 inch per foot unless otherwise shown.

### 3.3 DRAIN PIPE AND FITTINGS

- A. Offsets and Fittings.
  1. Use reduction fittings to connect two pipes of different diameter.
  2. Change directions by appropriate use of 45-degree wyes, long-sweep quarter-bends, and sixth-, eights-, and sixteenth-bends. Sanitary tees can be used on vertical stacks. Use long sweeps at the base of risers.
  3. Provide a separate trap at each fixture, unless a trap is built into the fixture. Provide a deep seal trap at each floor drain and hub drain. Place traps so that the discharge from any fixture will pass through only one trap before reaching a building drain.
  4. Refer to Sanitary Drainage Code section for acceptable fittings to be used for changes in direction of drainage flow. Double combo sanitary fittings or double wye and 1/8<sup>th</sup> bend fittings are not allowed for horizontal to horizontal piping systems per Code.
- B. Hub Drains. Install hub drains where indicated, with the top of the hub 1/2 above the finished floor, unless otherwise indicated on the drawings.

## WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

- C. Cleanouts. Install cleanouts the same size as the soil waste lines in which the cleanouts are placed; however, no cleanout should be larger than 4 inches in diameter.
  - 1. Where cleanouts occur in pipe chases, bring the cleanouts through the walls and install covers. Where cleanouts occur in floor slabs, set flush. Reference drawing schedule.
  - 2. Provide cleanouts where soil lines change direction, every 50 foot on long runs, or as shown on the drawings, at the end of each horizontal waste line, and at the base of each riser (and at each increase in pipe size).
  - 3. Cleanouts shall occur at the end of each battery of water closets, urinals, lavatories, sinks, and single water closets. Cleanouts shall be installed so as to access the main sanitary or soil line. Extend and offset above flood rim of water closet.
  - 4. Double sanitary tees and double quarter bends do not allow for easy access to main lines, therefore these types of fittings are not allowed.
- D. Floor Drains. Locate floor drains 1/2-inch below finish floor elevation unless otherwise shown.

### 3.4 VENT PIPING

- A. Make vent connections to vent stacks with inverted wye fittings. Extend full-size vents through the roof to at least 6 inches above the roof.
- B. Flash the roof penetration with 6 lb. lead flashing approximately 24 inches square. Flange the flashing to the lead sleeve. Extend the flashing up and around the vent pipe. Turn the flashing down inside the pipe at least 2 inches to make a watertight joint. Flashing shall comply with the roofing manufacturer's requirements. Reference the Architectural Drawings for exact requirements.
- C. Locate vent piping through roof a minimum horizontal distance of not less than 20 feet from any air intake opening or supply fan.

### 3.5 TESTING

- A. Below Slab on Grade and All Floors in Multi-Story Buildings:
  - 1. Test pipe below slab on grade before backfilling and connecting to city sewers.
  - 2. Maintain not less than 10 foot of hydrostatic head for 1 hour without a leak.
  - 3. Before acceptance of the work the contractor must ensure the piping is in working order before and after the slab is poured. To ensure this the contractor must test completed systems in the presence of the Architect, Engineer and authorities having jurisdiction after installation is complete.
  - 4. Maintain the test on the system till after the slab is poured. Provide an accessible connection that may be reviewed by Architect, Engineer and authorities having jurisdiction prior to and after the slab is poured.
  - 5. Test drainage piping systems in accordance with governing codes and the requirements specified. Provide equipment and materials and make test connections required to execute tests.
  - 6. Test drainage and waste piping hydraulically by filling system to its highest point or, whichever is greater, at a static head of 10 feet. Leaks at any joint shall be sufficient cause for rejection.
  - 7. Air tests may be substituted for hydraulic tests by forcing air into the closed system at a uniform pressure sufficient to balance a column of 10 inch hg in height.
  - 8. Under any of the previously described tests, the water height shall remain constant, after stabilization, for not less than 15 minutes without any further addition of water.
- B. System Test. After the various sections of soil, waste and vent piping are installed, but before fixtures are connected, test the system by:
  - 1. Plugging outlets.
  - 2. Filling vertical sections of multiple story buildings of not less than three floors at a time with water. Provide wyes as required to facilitate plugging.
  - 3. Test for 6 hours without any drop in the water level.

### 3.6 RODDING SEWERS

- A. All sanitary soil and waste lines, both in the building and out, shall be rodded out and flushed out after completion of construction and prior to finish floor being installed. All work must be completed

### SOIL, WASTE AND SANITARY DRAIN PIPING, VENT PIPING AND APPURTENANCES

prior to substantial completion. All floor drains and cleanout locations must be included in this work.

- B. All sanitary soil and waste lines below building 3" and larger shall be internally videotaped at time of substantial completion. All videotaping shall include on-screen date and time, and include audio narration. All videotaping shall be provided by experienced individual in videotaping piping systems. An Owner's Representative shall be present during video-taping. Three copies of the videotape shall be delivered to the Owner for future records.
- C. This work shall be done in the presence of the Owner's Representative, as part of the Contract, to ensure all lines are clear, and any obstruction that may be discovered shall be removed immediately. Rodding shall be accomplished by utilizing the proper rotary head to clear sewer. Pipe sizes 8 inches and larger shall be hydro-flushed.

END OF SECTION

SECTION 22 20 00

PLUMBING PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 22 - Plumbing.

1.2 RELATED WORK

- A. Division 22 Plumbing
1. Earthwork
  2. Valves, Strainers and Vents
  3. Insulation
  4. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
  2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
  3. Use silver brazing alloy or Sil-Fos on underground water entry piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
  2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
  3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
  4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
  5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges

PLUMBING PIPE AND PIPE FITTINGS – GENERAL

- inside and outside.
- 6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.
- F. No Hub. Hubless joints shall be made with wide body, neoprene sealing sleeve with stainless steel sleeve, coupling joints conforming to ASTM C 1277.
  - 1. 4" pipe size and smaller coupling housing minimum of 3" width; 24 gauge Series 300 stainless steel with hi-torque clamps; neoprene coupling gasket.
  - 2. 6" through 10" pipe size coupling housing minimum of 4" width.
  - 3. Tighten clamps to within manufacturer's tolerances using preset torque wrench.
- G. Mechanical Joints. Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
  - 1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
  - 2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
  - 3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
  - 4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.
- H. Compression Joints for Cast Iron Water Pipe. Use Beltite, Tyton or Grip-Tite compression joints. Install in accordance with the manufacturer's recommendations for compression joints. Provide adequate concrete thrust blocks at changes of direction, as recommended by the manufacturer.
- I. Ring-Tite Joints: Ring-Tite gasketed sewer fittings for sanitary and storm. Furnish joints for installation manufactured per ASTM/CSA, IpeX, and J.M Eagle C900. Provide adequate concrete thrust blocks at changes in direction, as recommended by manufacturer.
- J. Press fittings for copper pipe 1/2" to 4": Copper press fittings shall conform to the material and sizing requirements of ASTM B16.18 or ASME B16.22. O-rings for copper press fittings shall be EPDM. Pro-Press System manufactured by VIEGA. The system intended for use shall be approved by submittal. Systems from various manufacturers may vary in technology. The field personnel shall carry training credentials from the approved manufacturer for the project. Mixing of fittings from different manufacturers is strictly prohibited.

## 2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
  - 1. Where pipe materials of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

## 2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller. For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. Use Weld-o-let when branch is smaller than header. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

## 2.5 GASKETS

- A. High Temperature Piping. Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping. Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

## 2.6 FLOORS AND CEILING PLATES

### PLUMBING PIPE AND PIPE FITTINGS – GENERAL

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

## 2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America unless specifically named in these specifications.

## PART 3 - EXECUTION

### 3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.
- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.
- E. Press Connections: Copper and steel press fittings ½" through 4" shall be applied in accordance with the manufacturer's installation instructions. The tubing/pipe shall be fully inserted into the fitting and the tubing/pipe marked at the shoulder of the fitting. The fitting alignment shall be checked against the mark on the tubing/pipe to assure the tubing/pipe is fully engaged (inserted) in the fitting. The joints shall be pressed using the tool approved by the manufacturer. If soldering (thread adapters, etc.) near press fittings, take precautions to not damage the O-ring fittings. Maintain three pipe diameters or use a cooling agent. Viega-"Pro-Press".

### 3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

### 3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.

- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

### 3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging.
- B. Provide supports both sides of elbows for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On cold water pipe, supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion.
- F. Use electro-galvanized or zinc plated threaded rods, nuts, washers and hangers.
- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Feet	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

### 3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanize members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

### 3.6 PIPE SUPPORTS ON ROOF

- A. Support gas pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.



3.7 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

3.8 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
  - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
  - 2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
  - 1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.
  - 1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
- D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
- E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
- F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
- G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
- H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.

3.10 ISOLATION VALVES

- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.

3.11 DRAIN VALVES

- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.

3.12 CLEANING OF PIPING SYSTEMS

- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate.

- B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
- C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
- D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
- E. Dispose of water in approved manner.
- F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Flush system and replace with clean water.
- G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.

### 3.13 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

### 3.14 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
  - 1. Both sides of penetrations through walls, floors and ceilings.
  - 2. Close to valves or flanges.
  - 3. Intervals on straight pipe runs not to exceed 50 feet
  - 4. Apply marker where view is obstructed.

- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

END OF SECTION

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SECTION 22 40 00

PLUMBING FIXTURES AND FIXTURE CARRIERS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install water closets, urinals, lavatories, electric drinking fountains, fixture carriers and plumbing appurtenances.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Drains, Hydrants and Cleanouts.
  - 2. Domestic Water Piping.
  - 3. Soil, Waste and Sanitary Drain Piping and Vent Piping.

1.3 JOB REQUIREMENTS

- A. Furnish plumbing fixtures and trim as shown and specified. Provide faucets, fittings, supply stops and similar devices of a single manufacturer. Furnish faucets and supply stops with renewable seats. Wall hung fixtures shall be installed with a fixture carrier.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Plumbing Fixtures (Vitreous China):
  - 1. American Standard.
  - 2. Kohler.
  - 3. Toto
  - 4. Zurn
- B. Plumbing Faucets:
  - 1. American Standard.
  - 2. Chicago.
  - 3. T&S Brass.
  - 4. Zurn.
- C. Supports and Carriers:
  - 1. Wade
  - 2. Zurn
  - 3. J.R. Smith.
  - 4. Josam.
  - 5. Watts
  - 6. MIFAB
- D. Flush Valves:
  - 1. Sloan
  - 2. Zurn
- E. Supplies, Stops and Chrome Plated Tubular Brass:
  - 1. McGuire
  - 2. Kohler
  - 3. Chicago
  - 4. Zurn
- F. Water Closet Seats:
  - 1. Beneke
  - 2. Church
  - 3. Olsonite
  - 4. Bemis

PLUMBING FIXTURES AND FIXTURE CARRIERS

- G. Electric Drinking Fountains:
  - 1. Halsey Taylor
  - 2. Elkay
  - 3. Oasis
  
- H. Floor Drains:
  - 1. Wade
  - 2. J.R. Smith
  - 3. Josam
  - 4. Zurn
  - 5. Watts
  - 6. Sioux Chief
  - 7. MIFAB
  
- I. Cleanouts:
  - 1. Wade
  - 2. J.R. Smith
  - 3. Josam
  - 4. Zurn
  - 5. Watts
  - 6. MIFAB
  
- J. Shower Valves
  - 1. Chicago
  - 2. Acorn
  - 3. Symmons
  - 4. Bradley
  - 5. Moen Commercial
  
- K. Shower Stall
  - 1. Aquabath
  - 2. Aquatic
  - 3. Aquarius
  - 4. Best Bath Systems (Access)
  
- L. Stainless Steel Sinks:
  - 1. Elkay
  - 2. Just
  - 3. Griffin
  - 4. Amtekco Industries
  
- M. Mop Sinks:
  - 1. Crane Fiat
  - 2. Stern Williams
  - 3. Acorn
  
- N. Roof Drains:
  - 1. Wade
  - 2. J.R. Smith
  - 3. Josam
  - 4. Zurn
  - 5. Watts
  - 6. MIFAB
  
- O. Thermostatic Mixing Valves
  - 1. Lawler
  - 2. Symmons
  - 3. Leonard
  - 4. Powers
  - 5. Bradley
  
- P. Emergency Safety Equipment

1. Speakman
  2. Bradley
  3. Encon
  4. Guardian
- Q. Shock Arrestors:
1. Precision Products
  2. Sioux Chief
- R. Backflow Preventors
1. Watts
  2. Febco
  3. Wilkins
- S. Hose Bibbs
1. Wade
  2. Chicago
  3. Josam
  4. Woodford
  5. Zurn
  6. J.R. Smith
  7. MIFAB
- T. Wall Hydrants
1. Wade
  2. Woodford
  3. Zurn
  4. J.R. Smith
  5. Josam
  6. MIFAB

## 2.2 REQUIREMENTS

- A. Refer to the drawings for equipment to be supplied.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation shall be in accordance with the manufacturer's instructions.
- B. Make rough-in and final connection of service to each fixture provided under this Section and other Sections or Architectural or Plumbing Drawings.
- C. Provide necessary stops, valves, traps, unions, vents, cold water, hot water, sanitary, etc. for a complete installation.
- D. Provide isolation valves in domestic water lines to isolate all equipment, restrooms, hose bibbs, and where shown on drawings.
- E. Remove piping and services roughed-in incorrectly and install correctly, without cost.
- F. Exposed piping, fittings and appurtenances shall be chrome-plated brass.
- G. Coordinate with the Contractor for locations and service required for each plumbing fixture.
- H. All floor drains and floor sinks shall have Pro-Set "Trap Guard" for trap seal protection.
- I. All floor drains and floor sink locations are to be coordinated with all equipment. Locate drains in mechanical equipment spaces to conform to drain locations of equipment furnished. Coordinate drain location with food service equipment and Architectural Drawings.
- J. All floor drains, floor sinks and cleanout covers are to be provided with stainless steel vandal

resistant screws.

- K. Trap primer valves installed in concealed spaces shall have approved access doors for accessibility.

END OF SECTION



SECTION 22 63 11

GAS PIPING AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install steel gas pipe inside buildings, including the supply line from the meter, service lines to gas equipment and appliances, termination of the service line with a plug valve, drip leg, and final connection to equipment and appliances with unions.
- B. Coordinate service line from utility main and extend to meter. Coordinate installation of the service line and meter with Gas Company.
- C. Extend steel gas piping from meter to inside the building to all fixtures, appliances and equipment requiring gas.

1.2 RELATED WORK

- A. Division 22 Plumbing
  - 1. Plumbing Pipe and Fittings
  - 2. Valves and Vents

1.3 UTILITY CONNECTIONS

- A. Make arrangements for and pay all fees and connection charges for obtaining service to the building.

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS - ABOVE GRADE

- A. Pipe 2 inch and Smaller:
  - 1. Schedule 40 ASTM A 53 black steel pipe
  - 2. Factory fabricated socket weld fittings.
- B. Pipe Larger than 2 inch:
  - 1. Schedule 40 ASTM A 53 black steel pipe.
  - 2. Factory fabricated butt weld fittings for welded steel pipes shall conform to ASTM A-234 WPB (seamless weld fittings).
- C. Unions:
  - 1. Standard 150 lb. (300 lb. water, oil or gas) malleable iron.
  - 2. Ground joint unions, with bronze seat.
  - 3. Flange joints for pipe larger than 2 inch in diameter.
- D. Flanges:
  - 1. Steel flanges. ANSI B16.5 and ASTM A-105.

2.2 PIPE AND FITTINGS - BELOW GRADE OUTSIDE BUILDING

- A. Polyethylene pipe shall be ASTM D3350 Grade PE24 cell classification and ASTM D1248 Class B material classification.
- B. Pipe shall be medium density polyethylene PE 2406 and PE 2708 manufactured by Poly Pipe

GAS PIPING AND APPURTENANCES

Industries, Inc. or Performance Pipe.

- C. Polyethylene yellow molded butt fittings for use with medium density polyethylene pipe shall meet testing requirements of ASTM D2513 and resin material listing of ASTM D3350 with PPI designation of PE 2406 as manufactured by Central Plastics Co.

## 2.3 VALVES

- A. See Section 22 05 23.

## 2.4 GAS PRESSURE REGULATOR

- A. Size the gas pressure regulator in accordance with the manufacturer's recommendations for flow quantities and reduced pressure as required for all equipment. Coordinate final equipment gas pressure requirements prior to ordering regulators. Provide American Meter Company regulators or approved equal, suitable for outdoor installation. Regulators outside exposed to weather shall be installed with vent in vertical down position.
- B. All line pressure regulators shall be listed ANSI (American National Standard) E2.180A-2000 and CSA (Canadian Standards Association Standard) CGA6.22A-M00.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation Standards: Install gas piping in accordance with recommendations of the National Fire Protection Association.
- B. Drip Legs: Install a capped drip leg 6 inches long at the base of each vertical rise.
- C. Coating and Wrapping. Coat and wrap underground piping in accordance with the service utility company standards.
- D. Sleeves.
  - 1. Encase gas piping running in or through solid partitions with thin wall metal conduit. Sleeve piping and fittings shall be two pipe sizes, but not less than 1 inch larger than encased gas piping.
  - 2. Encase gas piping running below slab in Schedule 40 PVC, minimum size two pipe sizes larger than gas pipe. Vent sleeve to atmosphere with a 1-1/2 inch vent with 1-1/2 inch return bend above building roof. Seal ends of sleeve with UL fire rated caulk.
- E. Do not install gas piping exposed to view inside public area, or occupied spaces, without prior written approval.
- F. Weld all gas piping above grade.
- G. Provide test ports and isolation valves to enable proper testing of system in the future.
- H. Provide isolation valve and unions across regulators for proper removal.
- I. Provide transition risers where below grade polyethylene pipe changes to steel pipe above grade.
- J. Gas Pressure Regulators / Vents:
  - 1. Piping shall be sized in accordance with the regulator manufacturer's instructions. Where there is more than one regulator at a location, each regulator shall have a separate vent to the roof / outdoors.
  - 2. Install vent piping from regulators to location to prevent gas smells from entering building.

3. Install double elbows and insect screen at end of piping to prevent moisture and insects from entering.
4. When installed inside building route vents horizontally and terminate through building sidewall. Vents terminating through roof must have prior approval from Architect before installation. Through roof penetrations shall be minimized.
5. Regulators installed outside or on roof top: Install regulator vent turned downward with insect screen over vent opening. The vent shall be designed to prevent the entry of water, insects, or other foreign materials that could cause blockage.

### 3.2 TESTING GAS PIPING

- A. Preliminary gas test as required by Code, but minimum test pressure of 50 PSI held for not less than eight hours without noticeable drop.
- B. Test joints with a soap solution while lines are under pressure.
- C. Repair leaks.
- D. Final gas test shall be with a 24 inch column of mercury or a diaphragm gauge with a minimum dial size of 3-1/2 inches with a set hand and a pressure range not to exceed twenty (20) psig with 2/10-pound increments. The minimum test pressure shall not be less than ten (10) psi and the maximum test pressure shall not exceed twelve (12) psig. This test will be observed for no less than (30) thirty minutes with no drop in pressure.
- E. Provide copy of gas pressure test reports in Operations & Maintenance Manual.
- F. Provide Railroad Commission of Texas Pipeline Safety Form PS-86B.
  1. To find form online, go to: Texas School Gas Test Form
- G. School renovations projects shall have all gas piping tested. Report and document gas leaks found to the Architect and Engineer. Repair leaks at no additional cost to the Owner.

### 3.3 IDENTIFICATION CONDUCTOR

- A. Spiral A #12 AWG insulated copper conductor the full length of the thermoplastic piping system. Fasten to the pipe at 3 foot intervals with plastic tie wraps.
- B. Terminate at each end in a 12 inch x 12 inch x 4 inch FRP junction box.
  1. Bolted gasketed cover with stainless steel screws.
  2. Screw type terminal strip.
  3. Legend on cover "gas pipe identification conductor."
- C. Set in concrete pad.

### 3.4 PAINT EXPOSED OUTSIDE GAS PIPE

- A. Interior and Exterior Gas piping shall be protected from rust.
- B. Paint pipe with a flat alkyd coating, clean pipe prior to painting by preparing surface by hand tool cleaning per SSPC-SP2-82, applying one coat of Glidden Y-590 Rustmaster Metal Primer White and top coat of Yellow Alkyd Flat Enamel.

END OF SECTION

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SECTION 23 01 00

HVAC OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Compilation product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare operating and maintenance data as specified.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three copies of complete manual in final form.

1.2 SUBMITTALS

- A. Thirty (30) days after the Contractor has received the final scheduled identified submittals bearing the Architect/Engineer's stamp of acceptance (including resubmittals), submit for review one copy of the first draft of the Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element.
  - 2. Contractor information.
  - 3. All submittals, coordination drawings and product data, reviewed by the Architect/Engineer; bearing the Architect/Engineer's stamp of acceptance. (When submittals are returned from Engineer "Correct as Noted", corrected inserts shall be included.)
  - 4. All parts and maintenance manuals for items of equipment.
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed. Submit forms and outlines of certifications that have not been completed.
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates).
  - 9. Control operations/equipment wiring diagrams.
  - 10. Schedule of filters for each item of equipment.
  - 11. Schedule of belts for each item of equipment.
  - 12. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit three (3) completed manuals in final form to the Architect/Engineer one day after substantial completion, and prior to Owner's instructions. Include all specified data, test and balance reports, drawings, dated warranties, certificates, reports, along with other materials and information.
- D. The Architect/Engineer will review the manuals for completeness within fifteen (15) days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Two (2) complete Manuals will be delivered to the Owner.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black three-ring binders with clear overlay plastic covers.
- B. Minimum ring size: 1".  
Maximum ring size: 3".
- C. When multiple binders are used, correlate the data into related groupings.

HVAC OPERATING AND MAINTENANCE MANUALS

- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

### PART 3 - EXECUTION

#### 3.1 OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
1. Prepare data in form of an instructional manual for use by Owner's personnel.
  2. Format:
    - a. Size: 8-1/2" x 11".
    - b. Text: Manufacturer's printed data or neatly typewritten.
  3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable.
    - c. Identity of general subject matter covered in the manual.
  6. Binder as specified.
- B. Content of Manual:
1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number.
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer.
      - 2) Maintenance contractor as appropriate.
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement.
    - d. Identify each product by product name and other identifying symbols as set forth in Contract Documents.
  2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information. (All options not supplied with equipment shall be marked out indicated in some manner.
  3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems.
      - 2) Control and flow diagrams.
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  4. Written text, as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  5. Copy of each warranty, bond and service contract issued.
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure.
      - 2) Instances that might affect validity of warranties or bonds.
  6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems.
1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts.
      - 1) Function, normal operating characteristics, and limiting conditions.

- 2) Performance curves, engineering data and tests.
  - 3) Complete nomenclature and commercial number of replaceable parts.
  - b. Operating procedures:
    - 1) Start up, break-in, routine and normal operating instructions.
    - 2) Regulation, control, stopping, shut down and emergency instructions.
    - 3) Summer and winter operating instructions.
    - 4) Special operating instructions.
  - c. Maintenance procedures:
    - 1) Routine operations
    - 2) Guide to trouble-shooting.
    - 3) Disassembly, repair and reassembly.
    - 4) Alignment, adjusting and checking.
    - 5) Routine service based on operating hours.
  - d. Servicing and lubrication schedule. List of lubricants required.
  - e. Manufacturer's printed operating and maintenance instructions.
  - f. Description of sequence of operation by control manufacturer.
  - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - 1) Predicted life of part subject to wear.
    - 2) Items recommended to be stocked as spare parts.
  - h. As installed control diagrams by controls manufacturer.
  - i. Complete equipment internal wiring diagrams.
  - j. Schedule of filters for each air handling system.
  - k. Schedule of belts for each item of equipment.
  - l. Each Contractor's coordination drawings.
  - m. As installed color coded piping diagrams.
  - n. Charts of valve tag number, with location and function of each valve.
  - o. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
  - p. Other data as required under pertinent sections of the specifications.
- 2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  - 3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications.
  - 4. Provide complete information for products specified in Division 23.
  - 5. Provide certificates of compliance as specified in each related section.
  - 6. Provide start up reports as specified in each related section.
  - 7. Provide signed receipts for spare parts and material.
  - 8. Provide training report and certificates.
  - 9. Provide extended compressor warranty certificates.

END OF SECTION

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SECTION 23 05 00

MECHANICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of the General Requirements, and other provisions and requirements of the contract documents apply to work of Division 23 Mechanical.
- B. Applicable provisions of this section apply to all sections of Division 23, Mechanical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Mechanical work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department
  - 5. Texas Department of Licensing & Regulations (ADA)
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and organization to provide a practical working system
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date bids are received. Requirements in reference specifications and standards are minimum for all equipment, material, and work. In instances where specified capacities, size, or other features of equipment, devices, or materials exceed these minimums, meet specified capacities.

1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.

1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is at variance with the contract drawings. Mark the drawings with a colored

MECHANICAL GENERAL PROVISIONS

pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various lines, valves, ductwork, traps, equipment, and other pertinent items, as installed. Include flow-line elevation of sewer lines. Record existing and new underground and under slab piping with dimensioned locations and elevations of such piping.

- B. At the conclusion of project, obtain without cost to the Owner, erasable mylars of the original drawings and transfer as-built changes to these. Prior to transmittal of corrected drawings, obtain 3 sets of blue-line prints of each drawing, regardless of whether corrections were necessary and include in the transmittal (2 sets are for the Owner's use and one set is for the Architect/Engineer's records). Delivery of these as-built prints and reproducible is a condition of final acceptance. Provide record drawings on one set each (reproducible Dayrex mylar film positives) and AutoCad 2014 / Revit CAD files on disk (CD Rom).
- C. As-Built drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's seal, name, address and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all piping, ductwork, etc. that were deviated from construction drawings.
  - 6. Indicate exact location of all underground mechanical piping and elevation.
  - 7. Indicate exact location of all underground electrical raceways and elevations.
  - 8. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 9. Location and size of all ductwork and mechanical piping above ceiling including exact location of isolation of domestic and mechanical valves.
  - 10. Exact location of all electrical equipment in and outside of the building.
  - 11. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 12. Cloud all changes.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under that Division. Determine from the Contractor for the various trades, the Owner, and by direction from the Architect/Engineer, the exact location of all items.

#### 1.9 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is used in connection with insulating, painting, piping, ducts and the like, the work is understood to mean hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is understood to mean open to view.

#### 1.10 GUARANTEE

- A. Guarantee work for 1 year from the date of substantial completion of the project. During that period

make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

1.11 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

1.12 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If objectionable noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, rectify such conditions at no additional cost. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

1.13 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 23 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer will be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before bid due date. Submit complete design and performance data to the Engineer.

1.14 OPERATING TESTS

- A. After all mechanical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect/Engineer. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

1.15 WARRANTIES

- A. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.16 BUILDING CONSTRUCTION

- A. It shall be the responsibility of each sub-contractor to consult the Architectural and Engineering drawings, details, and specifications and thoroughly familiarize himself with the project and all job related requirements. Each sub-contractor shall cooperate with the General Contractor to verify that all piping and other items are placed in the walls, furred spaces, chases, etc., so there will be no delays in the job.

PART 2 - PRODUCTS – NOT USED

PART 3 - EXECUTION

3.1 OPENINGS

- A. Framed, cast or masonry openings for ductwork, equipment or piping are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.2 AIR FILTERS AND PIPE STRAINERS

- A. Immediately prior to substantial completion of the project, inspect, clean and service air filters and strainers. Replace air filters.

MECHANICAL GENERAL PROVISIONS

3.3 LUBRICATION, REFRIGERANT AND OIL

- A. Provide a complete charge of correct lubricant for each item of equipment requiring lubrication.
- B. Provide a complete and working charge of proper refrigerant, free of contaminants, into each refrigerant system. After each system has been in operation long enough to ensure completely balanced conditions, check the charge and modify for proper operation as required.
- C. Provide a complete charge of special oil for refrigeration use, suitable for operation with refrigerant, in each system.

3.4 HOUSEKEEPING PADS

- A. Provide equipment housekeeping pads under all floor mounted and ground mounted HVAC equipment, and as shown on the drawings.
- B. Concrete work as specified in Division 3.
- C. Concrete pads:
  - 1. 4" high, rounded edges, minimum 2500 psi unless otherwise indicated on the drawings
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Doweled to existing slab
- D. Install concrete curbs around duct penetrations or multiple pipe penetrations.

3.5 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to final inspection, conduct an on-site training program to instruct the Owner's operating personnel in the operation and maintenance of the mechanical systems.
  - 1. Provide the training during the Owner's regular working day.
  - 2. The Instructors shall each be experienced in their phase of operation and maintenance of building mechanical systems and with the project.
- B. Time to be allocated for instructions.
  - 1. Minimum of 36 hours dedicated instructor time.
  - 2. 9 hours on each of 4 days.
- C. Before proceeding with the on-site training program, submit the program syllabus; proposed time and dates; and other pertinent information for review and approval.
  - 1. One copy to the Owner.
  - 2. One copy to the Architect/Engineer.
- D. The Owner will provide a list of personnel to receive instructions, and will coordinate their attendance at the agreed upon times.
- E. Use the operation and maintenance manuals as the basis of instruction. Review contents of manual with personnel in detail to explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of the training program that instructions have been satisfactorily completed. Give time and date of each demonstration and hours devoted to the demonstration, with a list of people present.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a

certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.

- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.6 EQUIPMENT IDENTIFICATION

- A. Provide a laminated engraved plastic nameplate on each piece of equipment and starter.
  - 1. Designation approved by Architect/Engineer.
  - 2. Equipment includes, but is not limited to, air handling units, fan coil units, variable volume boxes, fans, pumps, boilers and chillers.
  - 3. Submit schedule of equipment to be included and designations.
- B. Provide nameplates with 1/2" high letters and fastened with epoxy or screws.

### 3.7 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

### 3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.

### 3.9 INDOOR AIR QUALITY

- A. All equipment and ductwork shall be installed to allow sufficient space for testing, maintenance, and commissioning functions. Access doors or panels shall be installed in ventilation equipment, ductwork, and plenum enclosures for inspection and cleaning of outdoor air intakes, mixing plenums, up and downstream of coils, filters, drain pans and fans.
- B. Practice source control and eliminate potential contaminants in material selection, installation, and maintenance.
- C. Provide installation and disposal instructions for all materials and chemicals that are potential contaminants.
- D. Obtain and conform to the requirements of the Material Safety Data Sheets (MSDSs) in the use of materials.
- E. Utilize manufacturer's recommendations and provide installation instructions for all chemicals, compounds, and potential contaminants including pre-installation degassing if required.
- F. Ventilate completed building prior to final completion using no less than design outside air for at least 48 hours before occupancy.
- G. Make provisions for controls to prevent the entry of air contaminants into the HVAC air distribution system.

- H. Steps shall be taken to ensure that the HVAC system continues to function effectively and are not damaged or contaminated during construction activities.

END OF SECTION

SECTION 23 05 10

HVAC CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples. All exposed finishes shall be approved by the Architect. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing, adjusting, and balancing of equipment.
- B. Representative shall make written report of observations and recommendations to Architect / Engineer.

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS.

PART 3 - EXECUTION

3.1 PROTECTION OF EQUIPMENT

- A. Do not deliver equipment to the project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather will be rejected, and the Contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.
- B. Adequately protect equipment from damage after delivery to the project. Cover with heavy tarpaulins, drop cloths or other protective coverings as required to protect from plaster, paint, mortar and/or dirt. Do not cover with plastic materials and trap condensate and cause corrosion.

END OF SECTION



SECTION 23 05 11

MECHANICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspect and service existing equipment and materials that are to remain or to be reused.
- B. Disposal of equipment, materials, or housekeeping pads to be abandoned. Prior to disposal, the Contractor shall verify with the Owner what is to be salvaged by the Owner and what is to become the property of the Contractor.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Owner prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that existing conditions and devices are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractor's responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Contractor shall notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements, above and underground piping connections and flows.
- D. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.
- E. Field verify existing conditions and actual utility uses prior to final connections. Existing drawings may not have been available for all required information. Use pipe inspection camera system to field verify existing sanitary / grease waste connections. Verify actual HVAC supply and return

MECHANICAL ALTERATIONS PROJECT PROCEDURES

piping connections. Verify flow direction and depth prior to connection to existing plumbing systems.

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be cleaned and reconditioned, including cleaning of piping systems and HVAC coils prior to installation and reuse.
- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and be removed from the site.
- C. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner or the Architect / Engineer. Relocate material and / or equipment as directed by Owner.
- D. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- E. Materials, equipment and housekeeping pads not to be reused or reconnected shall be removed for Owner's review and salvaged by Contractor.
- F. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Contractor shall utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.

### 3.3 SEQUENCE AND SCHEDULE

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. Provide additional or temporary valves, piping, ductwork and connections to maintain existing systems in service during construction.
- C. Existing HVAC and Plumbing Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain permission from Owner at least 48 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Maintain acceptable temperature and humidity control within existing building during renovation activities.
- D. Remove and replace existing Mechanical systems and appurtenances as occasioned by new or remodeled construction. Re-establish service that may be interrupted by remodeled construction.
- E. Refer to other drawings series for work in remodeled areas. Where facilities in these areas are required to remain in service, any related work required to keep these facilities in operation is specified in this Division.
- F. Remove and replace existing piping, grilles, boxes and ductwork coincident with the construction.
- G. Remove or relocate existing piping, grilles, ductwork or housekeeping pads as occasioned by new or remodeled construction. Cap unused HVAC or domestic piping and duct beyond the new finish line.
- H. Relocate all HVAC and or domestic piping, grilles, boxes and ductwork as required to accommodate new work requiring precedence.
- I. Remove concrete housekeeping pad where materials or equipment have been removed.

- J. Remove all known utilities, which do not provide service to the buildings that remain.
- K. Remove existing plumbing or mechanical vent penetrations through roof not to be reused.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING MECHANICAL WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. HVAC, Plumbing, piping, ductwork and appurtenances to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Piping and ductwork not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. Repair adjacent construction and finishes damaged during demolition and extension work.
- F. Maintain access to mechanical installations that remain active. Modify installation or provide access panel as appropriate.
- G. Extend existing installations using materials and methods compatible with existing mechanical installations, or as specified.
- H. Existing mechanical piping and devices found to need additional hangers installed should be added at no additional cost to the Owner.

### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

### 3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new identification of all existing equipment to be reused and

located within the renovated areas. Do not include the description "existing". Provide new nameplates for all existing mechanical equipment in renovated areas as specified in Section 23 05 00 Mechanical General Provisions.

3.7 REFRIGERANT DISPOSAL

- A. Contractor shall dispose of refrigerant from all DX equipment including refrigerant piping per OSHA, EPA, Federal, State and Local Codes.

END OF SECTION

SECTION 23 05 12

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by these specifications as outlined below.
- B. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- C. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relationship to adjacent features, critical features, work, or products.
- D. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale:  $\frac{1}{4}" = 1'-0"$ .
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each mechanical room and for each outside equipment pad where equipment is located, submit plan and elevation drawings. Show:
  - 1. Actual mechanical equipment and components to be furnished
  - 2. Service clearance
  - 3. Relationship to other equipment and components
  - 4. Roof drains and leader piping
  - 5. Fire protection piping and equipment
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Related requirements:
  - 1. Ductwork shop drawings
  - 2. Coordination drawing specified in Division 26
- F. Submit shop drawings in plan, elevation and sections, showing equipment in mechanical equipment areas.
- G. Gas piping sketch indicating proposed location of piping prior to proceeding with the installation.

1.4 PRODUCT DATA AND INSTALLATION INSTRUCTION

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Submit only pages which are pertinent to the project. All options which are indicated on the product data shall become part of the contract and shall be required whether specified are not.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: COMPLY, DO NOT COMPLY, or NOT APPLICABLE. Explain all DO NOT COMPLY statements.
- F. Provide a separate transmittal for each submittal item. Transmittals shall indicate product by specification section name and number. Separate all submittals into appropriate specification section number. Do not combine specification sections.

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect/Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect/Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one reproducible transparency and three opaque reproductions.
  - 2. Product Data: Submit the number of copies which the contractor requires, plus those which will be retained by the Architect/Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and contact number.
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect/Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items:
  - 1. Finishes which involve Architect/Engineer selection of colors, textures or patterns
  - 2. Associated items which require correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect/Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make re-submittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a re-submittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made, other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect/Engineer that Contractor has either determined and verified all quantities, dimensions,

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

- C. Do not deliver any submittals to the Architect/Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect/Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule
  - 2. Affix stamp and initials or signature, and indicate requirements for re-submittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review and approval of submittals will not extend to design data reflected in submittals which is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review and approval is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Div. 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION - NOT USED

END OF SECTION



SECTION 23 05 13

ELECTRICAL PROVISIONS OF HVAC WORK

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical provisions to be provided as mechanical work are indicated in other Division 23 sections, on drawings, and as specified.
- B. Types of work, normally recognized as electrical but provided as mechanical, specified or partially specified in this Section, include but are not necessarily limited to the following:
  - 1. Motors for mechanical equipment.
  - 2. Starters for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 3. Wiring from motors to disconnect switches or junction boxes for motors of mechanical equipment, but only where specifically indicated to be furnished integrally with equipment.
  - 4. Wiring of field-mounted float control switches, flow control switches, and similar mechanical-electrical devices provided for mechanical systems, to equipment control panels.
  - 5. Wiring of smoke detectors for shutdown of air handling equipment when a fire alarm system is not included in the project.
  - 6. Wiring of oil pump, vibration and oil level limit switches for cooling towers.
  - 7. Refrigerant monitor/sensor/alarming and field installed visual/audible display alarms.
  - 8. Pipe heat tracing.
  - 9. Cooling tower vibration switch/interlock/reset.
  - 10. Field interlock wiring from chiller: flow switches, pump aux. Contacts, pump start/stop.
  - 11. Power supply 120 VAC and control signal from chiller control panel to condenser water flow control valve installed in piping leaving chiller.
  - 12. Wiring of all related circulating water system chemical treatment devices.
    - a. Low voltage electric contacting water meter
    - b. Solenoid valve/blow-down assembly
  - 13. Radiant heater timer switches and/or thermostats
  - 14. Low Voltage thermostat wiring
- C. Refer to Division 23 Controls Sections for related control system wiring.
- D. Refer to Division 23 sections for specific individual mechanical equipment electrical requirements.
- E. Refer to Division 26 sections for motor starters and controls not furnished integrally with mechanical equipment.
- F. Refer to Division 26 sections for junction boxes and disconnect switches required for motors and other electrical units of mechanical equipment.

1.2 RELATED WORK

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to work of this Section.

1.3 QUALITY ASSURANCE

- A. Wherever possible, match elements of electrical provisions of mechanical work with similar elements of electrical work specified in Division 26 sections for electrical work not otherwise specified.
- B. For electrical equipment and products, comply with applicable NEMA standards, and refer to NEMA standards for definitions of terminology. Comply with National Electrical Code (NFPA 70) for workmanship and installation requirements.

1.4 SUBMITTALS

ELECTRICAL PROVISIONS OF HVAC WORK

- A. Include in listing of motors, voltage, notation of whether motor starter is furnished or installed integrally with motor or equipment containing motors.

## PART 2 - PRODUCTS

### 2.1 MOTORS

- A. Provide motors for mechanical equipment manufactured by one of the following:
  - 1. Baldor Electric Company.
  - 2. Century Electric Div., Inc.
  - 3. General Electric Co.
  - 4. Louis Allis Div.; Litton Industrial Products, Inc.
  - 5. Lincoln Electric
  - 6. Marathon Electric Mfg. Corp.
  - 7. Reliance Electric Co.
  - 8. Westinghouse Electric Corp.
  - 9. WEG
- B. Motor Characteristics. Except where more stringent requirements are indicated, and except where required items of mechanical equipment cannot be obtained with fully complying motors, comply with the following requirements for motors of mechanical work:
- C. Temperature Rating. Rated for 40 Degrees C environment with maximum 50 Degrees C temperature rise for continuous duty at full load (Class A Insulation).
- D. Provide each motor capable of making starts as frequently as indicated by automatic control system, and not less than 5 starts per hour for manually controlled motors.
- E. Phases and Current Characteristics. Provide squirrel-cage induction polyphase motors for 3/4hp and larger, and provide capacitor-start single-phase motors for 1/2hp and smaller, except 1/6hp and smaller may, at equipment manufacturer's option, be split-phase type. Coordinate current characteristics with power specified in Division 26 sections, and with individual equipment requirements specified in other Division 23 requirements. For 2-speed motors provide 2 separate windings on polyphase motors. Do not purchase motors until power characteristics available at locations of motors have been confirmed, and until rotation directions have been confirmed.
- F. Service Factor. 1.15 for polyphase motors and 1.35 for single-phase motors.
- G. Motor Construction. Provide general purpose, continuous duty motors, Design "B" except "C" where required for high starting torque.
  - 1. Frames. NEMA #56.
  - 2. Bearings are to be ball or roller bearings with inner and outer shaft seals, regreasable except permanently sealed where motor is inaccessible for regular maintenance. Where belt drives and other drives produce lateral or axial thrust in motor, provide bearings designed to resist thrust loading. Refer to individual section of Division 23 for fractional-hp light-duty motors where sleeve-type bearings are permitted.
  - 3. Except as indicated, provide open drip-proof motors for indoor use where satisfactorily housed or remotely located during operation, and provide guarded drip-proof motors where exposed to contact by employees or building occupants. Provide weather-protected Type I for outdoor use, Type II where not housed. Refer to individual sections of Division 23 for other enclosure requirements.
  - 4. Provide built-in thermal overload protection and, where indicated, provide internal sensing device suitable for signaling and stopping motor at starter.
  - 5. Noise Rating: Provide "Quiet" rating on motors.
- H. All motors shall be premium efficiency.
- I. Provide an inverter duty motor on all equipment that utilizes a variable frequency drive.

### 2.2 EQUIPMENT FABRICATION

- A. Fabricate mechanical equipment for secure mounting of motors and other electrical items included in work. Provide either permanent alignment of motors with equipment, or adjustable mountings as applicable for belt drives, gear drives, special couplings and similar indirect coupling of equipment. Provide safe, secure, durable, and removable guards for motor drives. Arrange for lubrication and similar running-maintenance without removal of guards.

## 2.3 GENERAL REQUIREMENTS – SHAFT GROUNDING RINGS

- A. All motors operated on variable frequency drives shall be equipped with a maintenance-free, conductive microfiber shaft grounding ring to meet NEMA MG-1, 3.4.4.4.3 requirements, with a minimum of two rows of circumferential microfibers to discharge damaging shaft voltages away from the bearings to ground. SGR's Service Life: Designed to last for service life of motor. Provide AEGIS SGR Conductive MicroFiber Shaft Grounding Ring, or approved equal.
- B. Application Note: Motors up to 100 HP shall be provided with one shaft ground ring installed on either the drive end or non-drive end. Motors over 100 HP shall be provided with an insulated bearing on the non-drive end and a shaft grounding ring on the drive end of the motor with the exception of line contact bearings in the drive end of the machine. In this instance the line contact bearing must be electrically insulated and the AEGIS Bearing Protection Ring installed on the opposite drive end of the motor. Grounding rings shall be provided and installed by the motor manufacturer's recommendations.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install motors on motor mounting systems in accordance with motor manufacturer's instructions, anchored to resist torque, drive thrusts, and other external forces inherent in mechanical work. Secure sheaves and other drive units to motor shafts with keys and Allen set screws on flat surface of shaft. Unless otherwise indicated, set motor shafts parallel with machine shafts.
- B. Verify voltage with Electrical Plans.

END OF SECTION

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SECTION 23 05 14

HVAC CONDENSATE DRAIN PIPING SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide and install air conditioning condensate drains.

1.2 RELATED WORK

- A. Division 23 - Mechanical
  - 1. Insulation
  - 2. Fan/Coil Units
  - 3. Air Handling Units
  - 4. Chilled Water Pumps

PART 2 - PRODUCTS

2.1 PIPE MATERIAL

- A. Type "L" copper with drainage pattern fittings.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Install the system to facilitate easy removal.
  - 1. Use threaded plugged tee at each change of direction to permit cleaning.
  - 2. Install a cleanout every 50 feet of straight run piping
  - 3. Maintain a positive slope on all piping
- B. Install a water seal trap leg based on the fan pressure.
  - 1. Size the length of the trap leg 1 inch larger than the actual system pressure.
- C. Install traps and cleanout as shown in the drawing details.
  - 1. Confirm requirements with manufacturer's installation instructions

3.2 SIZE PIPE AS SHOWN ON DRAWINGS

- A. Do not install piping sized smaller than the unit drain connection size.

3.3 SECONDARY DRAINS

- A. Provide secondary drains where required by code, shown on the drawings, or where equipment has secondary drain connections.

END OF SECTION

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SECTION 23 05 18

VARIABLE FREQUENCY INVERTER

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a variable frequency inverter for the following equipment items.
  - 1. Air Handling Units.

1.2 RELATED WORK

- A. Division 23 Mechanical
  - 1. Electrical Provisions of Mechanical Work.
  - 2. Air Handling Units
  - 3. Building Management Control System Sequences

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical to ensure that intended functions are achieved.
- B. Coordinate the size of the variable frequency inverter with the equipment being served by the inverter. The rated current output amps are to be equal to or greater than motor rated full load amps.

1.4 SUBMITTALS

- A. Submit manufacturer's information and shop drawings as specified.
  - 1. Complete technical details.
  - 2. Dimensions and manufacturer's installation manual.
  - 3. Schematic diagrams of the circuitry and field connections.
  - 4. Manufacturer's start-up manual.

1.5 STANDARDS

- A. UL.
- B. CSA.
- C. ISO 9001
- D. NEC.
- E. FCC.

1.6 WARRANTY

- A. The manufacturer shall provide a full parts and labor warranty for a period of five (5) years from substantial completion.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Danfoss Graham
- B. Yaskawa

2.2 CABINET

- A. The inverter and all accessories shall be provided within a wall mounted UL Listed NEMA 1

VARIABLE FREQUENCY INVERTER

enclosure. Cabinet shall be constructed of metal for reduction of radio frequency interference (RFI) and electromagnetic frequency interference.

## 2.3 INTERFERENCE WITH OTHER SYSTEMS

- A. The inverter shall be designed and constructed to comply with IEEE Standard 519-1993 with respect to line noise and RFI generation. All units shall generate less than 3% total harmonic distortion back to the incoming power line at the point of common connection with sensitive equipment. A harmonic analysis shall be submitted with the approval drawings to verify compliance with the latest version of IEEE-519 voltage and current distortion limits as shown in Table 1.2 and 10.3 at the point of common coupling (PCC). The PCC shall be defined as the consumer-utility interface or primary side of the main distribution transformer.
- B. Dual DC Bus filtered chokes (factory installed and wired in the drive enclosure) equivalent to 5% input line reactors shall be provided to minimize harmonics reflected onto the input line.
  - 1. Shall not interfere with computer and other electronic systems in the building.
  - 2. If not inherently protected, provide a suitable isolation transformer.
  - 3. The system shall not produce spikes on the incoming line.
- C. Any inverter that generates sufficient electrical line noise to interfere with the operation of sensitive building equipment shall be field modified or replaced by the inverter supplier at no additional cost to the Owner.

## 2.4 PROTECTIVE CIRCUITS

- A. Provide the following protection:
  - 1. Input line fuses or molded case circuit breaker rated at 100 AIC.
  - 2. Input line noise suppression with MOV's (metal oxide varistors) and snubber circuits. MOV's shall be provided across incoming line terminals, AC input reactors, DC choke filters, and transistors to protect inverter from voltage surges and spikes.
  - 3. Protection of solid state inverter devices by limiting output current to 110% of inverter rating, automatically prevent overcurrent trip due to momentary overload conditions.
  - 4. Current limiting DC buss fuse between input and output sections of inverter.
  - 5. Input overvoltage trip at 480 vac + 10% trip.
  - 6. Input undervoltage at 480 vac – 10% trip
  - 7. Instantaneous overcurrent protection of solid state inverter devices.
  - 8. Individual overcurrent protection of solid state inverter devices.
  - 9. Output overvoltage trip.
  - 10. Loss of input phase, phase reversals, or blown fuse.
  - 11. Thermal overload trip for overload protection of solid state devices.
  - 12. Ground fault protection on start-up.
  - 13. Output line to line short circuit protection.
  - 14. Phase to phase short circuit or severe overload conditions of output.
  - 15. Overload of motor.
  - 16. Frequency stall.
  - 17. DC buss high voltage.
  - 18. Control function error.
  - 19. Heatsink over temperature (Max. operating ambient: 122 degrees F)
  - 20. Controller able to operate without a motor or any other equipment connected to the output (To facilitate startup and troubleshooting).
  - 21. Capable of restarting into a rotating motor without component damage.
  - 22. Shut down safely without component failure in the event of a sustained power loss, and will automatically return to normal operation, if start is "on" and power is restored.
  - 23. Shut down safely without component failure in the event of a momentary power loss. Automatically return to normal operation if the start is "on", and normal power is restored. Capable of establishing speed control without shutdown or component failure.
  - 24. Designed for input power contactor opening or closing while control is activated, without damage to the controller.
  - 25. Automatically reset trip resulting from overcurrent, undervoltage, overvoltage, or over temperature, and automatically restart after removal, or correction of the faulty condition.
  - 26. Provide status lights or digital display for indication of failure conditions, and form C relay provided for remote indication. Digital display or status lights to indicate power on, at speed, and drive enabled.



27. Operation and fault diagnostic function circuits shall be built into each inverter that provides information in determining the cause and source of a fault. Diagnostics to provide the following information:
  - a. Operating mode at trip (Accel, Decel, Constant speed).
  - b. Output current at trip.
  - c. Output voltage at trip.
  - d. Additional faults that occurred simultaneously or immediately before displayed tripped.Any drive requiring separate card to provide this information shall provide a diagnostic card for each drive.
28. DC link reactor.
29. Input power disconnect, lockable type.
30. Input power disconnect switch / circuit breaker, with lockable type handle.

## 2.5 OPERATOR DEVICES

- A. The following operator devices shall be door or remote mounted:
  1. Digital keypad and LCD provided to perform all parameter adjustments, operation monitoring, and operation programming.
  2. Power on indication light.
  3. Flush mounted meters or digital display to indicate output voltage, output frequency, and output current, in percent of maximum 0 to 100%.
  4. Manual/Off/Auto 3 position selector switch (hand-off-auto) and manual speed setting control to provide the following control sequences:
    - a. In automatic mode, controller shall follow an external control signal and respond to remote start-stop contact.
    - b. In manual (hand) mode, controller shall follow speed signal set via door mounted keypad and start/stop switch. Switching from "hand" to "auto" and vice versa shall require a single keystroke to a dedicated changeover key. Inverters requiring multiple keystrokes and/or reprogramming of internal parameters to accomplish changeovers are not acceptable.
    - c. An integral "safety interlock" protection shutdown circuit shall be provided for interface with firestats, smoke detectors, high static pressure limit switches, vibration switches, etc.
  5. Programmable lockout code to prevent unauthorized programming.
  6. Critical frequency avoidance capability (up to 3 resonant points).

## 2.6 FIELD ADJUSTMENTS

- A. The following shall be adjustable in the field:
  1. Maximum Speed: 0 to 125% adjustable.
  2. Minimum Speed: 0 to 100% adjustable.
  3. Acceleration/deceleration rates: 0 to 3600 sec.
  4. Instantaneous overcurrent trip: 50% to 2000%.
  5. Volts/hertz ratio: Field adjustable to 16 patterns or set for automatic selection of proper V/F load profile to operate motor without overdriving or overloading.
  6. Current limit circuit: 60 to 100%.
  7. Carrier frequency: 6 to 16 KHZ.
  8. Control interface: selectable to follow a 0-5 VDC, 0-10 VDC, 4-20 MA, either direct or indirect acting.
  9. Control signal Bias: 0 to 80 HZ.
  10. Control signal gain: 0 to 80 HZ.
  11. Calibration of remote speed signal: 0 to 80 HZ.

## 2.7 ELECTRICAL CONSTANT SPEED BYPASS

- A. Provide all components and circuitry necessary to provide manual bypass of the inverter. The bypass package shall be mounted in a cabinet common with the inverter and shall be constructed in such a manner that the inverter can be removed for repair while still operating the motor in the "bypass" mode. Manual bypass shall contain the following:
  1. Two contactors mechanically interlocked via a three position through the door selector switch to provide the following control:
    - a. "Inverter" Mode connects the motor to the output of the inverter.

- b. "Bypass" Mode connects the motor to the input sine wave power. Transfer must occur with input disconnect open. Motor is protected via thermal overload.
- c. "Off" Mode disconnects motor from all input power.
- 2. A molded case circuit breaker or fused disconnect switch with door interlocked handle (lock out type) that interrupts input power to both the bypass circuitry and the drive.
- 3. An input contactor, interlocked with both the thermal motor overload and external safeties which disconnects power to the motor regardless of the mode of operation (either "inverter" or "bypass" mode).
- 4. A thermal overload to provide protection of motor in the bypass mode.
- 5. A safety interlock circuit that disconnects power to the motor (regardless of the mode of operation – "inverter" or "bypass") in response to a signal from the thermal overload and/or external safety circuits.
- 6. Line voltage to 24 volt DC power source, fused per NEC, shall provide power to all bypass control circuits.

## 2.8 SERIAL COMMUNICATIONS

- A. The VFD shall have the capability of communicating with the EMS control system via an RS-485 serial port.
- B. VFD shall be provided with protocol information specific to the selected EMS control manufacturer and shall be pre-configured at the factory to automatic communications, without the need for field programming.
- C. Serial communications capabilities shall be included, but not limited to: run/stop control, speed set adjustment, proportional/integral or PID control adjustments, current limit and accel/decel time adjustments. The drive shall also have the capability of allowing the DDC system to monitor the following feedback signals: process variable, output speed/frequency, current, torque, power (KW), operating hours, kilowatt hours; relay outputs, and diagnostic warning and fault information.
- D. The VFD shall allow the DDC system to control the drive's digital and analog outputs and monitor all drive digital and analog inputs via the serial interface.
- E. Provide BACnet interface card.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Installation as per manufacturer's recommendations and requirements.
  - 1. Inverter chassis is properly grounded.
  - 2. Line, Load, Control, and Fire/Safety wiring are installed in separate conduits.
  - 3. Both ends of conduit entering and leaving VFD into AHU cabinets and motors must be sealed air tight.

### 3.2 MANUFACTURER START-UP SERVICE

- A. Factory trained personnel shall be provided for start-up assistance, minimum (1) day per unit.
  - 1. The manufacturer shall provide start-up commissioning of the VFD and its optional circuits by a factory certified service technician who is experienced in start-up and repair services. Sales personnel and other agents who are not factory certified shall not be acceptable as commissioning agents.
  - 2. Start-up services shall include checking for verification of proper operation and installation for the VFD, its options and its interface wiring to the building automation system.
  - 3. Adjustable devices, components, and assemblies to assure optimum performance.
  - 4. Make final adjustments to the installed drive to assure proper operation of the fan system. Obtain performance requirements from installer of driven loads.
  - 5. Assistance will be provided to the Owner (upon request) to determine the optimum capacitance for per factory correction and avoidance of potential resonance problems and will determine optimum line filter required.
  - 6. A written report, duly signed by the technician detailing set points of adjustable devices, amperages recorded, and any other pertinent data. This information is to be included in the operation and maintenance manual.

- B. Input DC voltage to dry motor windings when fan is not in operation at the following locations:
  - 1. Cooling tower fan motor
  - 2. Motors downstream of coils
  - 3. Rooftop unit motors

3.3 DEMONSTRATION AND TRAINING

- A. Provide system demonstration to personnel, Owner, and/or Owner's selected representatives.
- B. Demonstrate operation of controllers in the automatic and manual modes.
- C. Provide a minimum of two days of technical training for the owner's operating and technical staff. Schedule training with owner's authorized representatives, during normal business hours and not less than 30 days prior to planned session.
- D. Training may be consecutive or random, at Owner's option.

END OF SECTION

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SECTION 23 05 19

HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. This section specifies gauges, thermometers, wells and/or pressure and temperature test stations to be installed as specified.

1.2 RELATED WORK

- A. Division 23, Mechanical
  - 1. 23 05 00 - Mechanical General Provisions
  - 2. 23 20 00 - Pipe and Pipe Fittings, General
  - 3. 23 05 23 - Valves, Strainers and Vents
  - 4. 23 21 13 - Hot Water and Chilled Water Piping, Valves and Appurtenances

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS - GAUGES AND THERMOMETERS

- A. Terice
- B. Taylor
- C. Marsh
- D. Weksler
- E. Marshalltown
- F. Weiss
- G. Miljoco

2.2 PRESSURE GAUGES

- A. Case and Ring: 4" type 304 stainless steel; liquid filled case with stainless steel bayonet ring.
- B. Dial: White aluminum with black markings
- C. Window: Clear acrylic
- D. Tube: Phosphor bronze and forged brass socket.
- E. Gauge accuracy: +/- 1% over operating range.
- F. For pulsating service, provide impulse dampers.
- G. Without flange for pipe mounting.
- H. With flange for wall mounting.
- I. Weiss Model: LF44S-1B or equal.

2.3 THERMOMETER WELLS

- A. Brass or type 300 stainless steel. Machined bar stock, 1-piece construction.
- B. Where installed in insulated piping or vessels, provide with extension neck to match insulation thickness.

HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

- C. Provide metal-to-metal contact with bulb chamber for maximum sensitivity.
- D. Wells shall be sized to extend a minimum of 50% into pipe.

#### 2.4 THERMOMETERS IN PIPING SYSTEMS OR VESSELS

- A. Die cast aluminum case with baked epoxy finish.
- B. Adjustable angle 9" scale length.
- C. Clear acrylic window.
- D. Brass stem, length to match well.
- E. Red reading organic spirit filled-in magnifying glass column.
- F. White background with black figures and markings.
- G. Brass stems and union connections.
- H. Accuracy: +/- 1% of scale range.
- I. Range:
  - 1. Hot water lines: 30°F to 240°F.
  - 2. Chilled water lines: 0°F to 100°F or 120°F
  - 3. Condenser water: 0°F to 100°F.

#### 2.5 PRESSURE AND TEMPERATURE TEST STATIONS

- A. "Test Station" fitting to receive either a temperature or pressure probe. Fitting shall be solid brass with two valve cores of Nordel.
  - 1. Fitted with a color coded cap strap with gasket.
  - 2. Acceptable Manufacturer: Peterson Equipment Company.
  - 3. Provide with extension neck to match insulation thickness.
- B. Provide to the Owner a fitted case with:
  - 1. Two 0-100 psi pressure gauges as specified and adapters with 1/8" OD probe.
  - 2. Four 5" stem pocket testing thermometers.
    - a. Two with range 25°F to 125°F for chilled water and condenser water.
    - b. Two with range 0°F to 220°F for hot water.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install in accordance with drawing details and manufacturer's recommendations.
- B. Provide a ball valve at each gauge.
- C. Locate gauges and thermometers to be easily readable from the floor at a 5'-6" eye level. Use adjustable angle or rigid stem as required. Install gauges in upright position.
- D. Install gauges in the following locations: across pumps, chiller cooler and condenser, storage tanks, heat exchangers.
- E. Test wells for automatic temperature controls shall be furnished by Building Management Control Section and installed by Mechanical Contractor.
- F. Install thermometer in the following locations: Across chiller cooler and condenser, storage tanks, across heat exchangers, across boiler, leaving side of water heater, leaving water side of tempered water valves, common chilled and hot water lines.
  - 1. Hot water lines: 30°F to 240°F.

#### HVAC PRESSURE AND TEMPERATURE INSTRUMENTS

2. Chilled water lines: 0°F to 100°F or 120°F
3. Condenser water 0°F to 100°F.

END OF SECTION

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SECTION 23 05 23

HVAC VALVES, STRAINERS AND VENTS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. HVAC Valves
- B. Pipe strainer and suction diffusers.

PART 2 - PRODUCTS

2.1 VALVES

- A. Pressure Ratings:
  - 1. Unless otherwise indicated, use valves suitable for 125 minimum psig working steam pressure (WSP) and 450°F.
  - 2. The pressure temperature rating of valves shall be not less than the design criteria applicable to components of the system.
- B. Butterfly Valves
  - 1. Butterfly valves shall conform to MSS-SP67.
  - 2. Liners, inserts and discs shall be suitable for the intended service.
  - 3. Valves shall have a full lug type body designed for installation between ANSI standard flanges, and shall be rated at full working pressure with downstream flange removed.
- C. Balancing Valves
  - 1. Provide balancing valves with:
    - a. Corrosion resistant plug with resilient seal when required.
    - b. O-ring stem seal.
    - c. Permanently lubricated, corrosion resistant bearings.
  - 2. Connections
    - a. Through 2" pipe size use threaded connections.
    - b. For valves 2-1/2" pipe size and larger shall be provided with 150 psig flange connections.
  - 3. Provide each valve with:
    - a. Memory stop.
    - b. Plastic drip cap.
    - c. 1/8" gauge tap.
- D. Ball Valves
  - 1. Provide ball valves with:
    - a. Blowout proof stem.
    - b. Full size port, 316 stainless steel ball and stem.
    - c. Cast bronze body.
    - d. Threaded ends.
  - 2. Seat, seals, thrust washers and packing shall be suitable for the intended service.
  - 3. Service rating:
    - a. 150 psi saturated steam.
    - b. 600 psi WOG.
  - 4. Where piping is insulated, ball valves shall be equipped with 2" extended handles of non-thermal conductive material. Provide a protective sleeve that allows operation of the valve without breaking the vapor seal or disturbing the insulation.
  - 5. Provide with memory stop for balancing valves.
- E. Valve Connections
  - 1. Provide valves suitable to connect to adjoining piping as specified for pipe joints. Use pipe size valves. Sweated joints are not allowed.
  - 2. Thread pipe sizes 2" and smaller.
  - 3. Flange pipe sizes 2-1/2" and larger.
  - 4. Use screw to solder adapters for copper tubing.

HVAC VALVES, STRAINERS AND VENTS

5. Use grooved body valves with mechanical grooved jointed piping.

F. Valve Operators

1. Where butterfly valves are provided:
  - a. Provide gear operators on valves 6" and larger.
  - b. Where valves are located 7' or more above the finished floor in equipment room areas provide chain-operated sheaves. Extend chains to about 5' above floor and hook to clips, arrange to clear walking space.
  - c. Lever lock handle with toothed plate for shut-off service and infinitely adjustable handle with lock and nut and memory stop for throttling service on valves 4" and smaller.
  - d. Provide worm gear operators on discharge side of pumps for balancing, for all sizes of valves.
  - e. All valves 2-1/2" and larger provided by Milwaukee Valve shall be provided with gear operators.

G. Acceptable Manufacturers

1. Dezurik
2. Crane
3. Nibco
4. Keystone
5. Milwaukee Valve

H. Check Valves

1. Bronze body, 2" and smaller, bronze disc (Teflon disc for steam service), regrinding swing check, screw-in cap, threaded connection.
2. Iron body, 2-1/2" and larger, bronze trim, non-slam: stainless steel pins and springs, and bronze plate or bronze mounted, regrind-renew check, bronze seat ring and disc. Provide either wafer or threaded lug.
3. Acceptable Manufacturers
  - a. Mission Duocheck
  - b. Nibco
  - c. Keystone
  - d. Milwaukee Valve

- I. Provide valves of same manufacturer throughout where possible.

- J. Provide valves with manufacturer's name and manufacturing location, duty and pressure rating clearly marked on outside of body.

- K. Where valves are installed in insulated piping, provide with extended neck so valve operator and stop plate clears the full thickness insulation.

- L. Provide valve, seat and trim materials suitable for the intended service.

- M. Provide memory stops for all valves used for throttling service. Valves for throttling service shall be butterfly, plug, caged or ball type.

N. Condenser Water Basin Float Valve:

1. Ductile Iron valve, body and cover
2. Stainless steel trim
3. Fully adjustable high and low level settings
4. Stainless steel float, float linkage and float rod
5. Flow clean strainer
6. CV Flow Control for opening and closing
7. ASTM A 536, B16.42, 150# Class
8. Stilling well
9. Acceptable Manufacturer: CLA-VAL

2.2 PIPE SYSTEMS STRAINERS

A. Body:

1. "Y" pattern or basket as shown on the drawings.

HVAC VALVES, STRAINERS AND VENTS

2. Line size.
  3. Threaded strainer blow down port.
  4. ASTM A #126 Class B Cast Iron Body.
- B. Construction:
1. 2" size and smaller with screw connections rated 400 psi WOG.
  2. Over 2" size with flanged connections, rated 125 psi WOG.
- C. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2".
  2. With 0.45 perforations in piping systems 2-1/2" and 3".
  3. With 0.125 perforations in piping systems 4" and larger.
- D. Start-up:
1. Provide an additional fine mesh disposable screen for use during start-up operations.
  2. Remove after 30 days.
  3. Attach to piping for owners review.
- E. Acceptable Manufacturers
1. Crane
  2. Keckley
  3. Zurn
  4. Mueller
  5. McAlear
  6. Muesco

## 2.3 SUCTION DIFFUSER

- A. For each pump as shown on the drawing, provide an angle type suction diffuser. Body is to fit both the pump inlet and suction pipe size.
- B. Components:
1. Inlet straightening vanes.
  2. Removable end cap.
  3. Gauge ports.
  4. Threaded strainer blow down port.
  5. Adjustable support foot.
  6. Removable magnetic insert.
- C. The screen shall be as specified for pipe system strainers.
- D. Provide an additional fine mesh disposable strainer for use during start up operations.
1. Remove after 30 days operation and all flushing is complete.
  2. Attach to piping for owners review.
- E. Construction:
1. 2" size and smaller with screw connections rated 400 psi WOG.
  2. Over 2" size with flanged connections, rated 125 psi WOG.
- F. Fabricate screens of Monel or type 304 stainless steel:
1. With 20 mesh woven wire in piping systems through 2".
  2. With 0.045 perforations in piping systems 2-1/2" and 3".
  3. With 0.125 perforations in piping systems 4" and larger.

## 2.4 VALVE SCHEDULE

- A. Hydronic Service
1. Chilled Water Service
    - a. Ball Valves up to 2": Nibco T-585-70-66 w/Nib-Seal insulated Handle
    - b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000  
Keystone Figure 222
  2. Heating & Condenser Water Service
    - a. Ball Valves up to 2": Nibco T-585-70-66

## HVAC VALVES, STRAINERS AND VENTS

- b. Butterfly Valve 2-1/2" and larger: Nibco LD - 2000  
Keystone Figure 222
- 3. Check Valve:
  - a. Nibco Check Valve: T - 413 - B
  - b. Nibco Check Valve 2-1/2" and larger: F - 918 - B
  - c. Nibco Check Valve 2-1/2" and larger: W - 920 -W (Wafer)
  - d. Keystone Check 2-1/2" and larger: FIQ 810

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install valves with stems upright or horizontal, not inverted.
- B. Install valves for shut-off and isolating service at each piece of equipment, at vertical risers, and where shown on the drawings.
- C. Use butterfly valves and ball valves in circulating water systems, for balancing duty. Provide infinite position gear operator with memory stop.
- D. Provide drain valves at main shut-off valves and low points of piping and apparatus so the systems can be entirely drained.
  - 1. 1" valve for pipes 6" and larger.
  - 2. 3/4" valve for pipes smaller than 6".
  - 3. Terminate with pipe plug.
  - 4. Drain valves shall be ball valves.
- E. Where valves are installed in insulated pipe, valve operator shall have an insert so the lever or handle will not damage the insulation. Install handles so the lever or handles will not damage the insulation.
- F. Provide clearance for installation of insulation and access to valves.
- G. Provide access where valves are not exposed.
- H. Provide float valves / stilling wells in cooling tower or condenser water basins for water level control. Provide stilling wells around float valve to prevent turbulence ripples or wind interference.
- I. Butterfly valves shall be installed per ASME B31.3 Process Piping, and ASME B16.5 Pipe Flanges and Flanged.

#### 3.3 PIPE SYSTEMS STRAINERS

- A. Provide an additional fine mesh disposable strainer for use during start up operations.
  - 1. Remove after 30 days operation and all flushing is complete.
  - 2. Attach to piping for owners review.
- B. Provide strainer in supply piping for all coil connections.
- C. Provide strainer in condenser water piping entering chiller.

#### 3.4 WATER SYSTEM AIR VENTS

- A. Provide manual air vents at high points and at any other air pockets of closed circulating pipe systems. Extend 3/8" hard drawn copper tubing discharge drains to nearest floor or hub drain. Provide 1/4" Ball Valve as specified.
- B. Where high point vents are not readily accessible provide additional valves at vent termination.

END OF SECTION

SECTION 23 05 48

VIBRATION ISOLATION

PART 1 - GENERAL

1.1 SCOPE

- A. Furnish, install, and adjust vibration isolation.

1.2 RELATED WORK

- A. Division 23 Mechanical.  
1. Refer to the Section on Ductwork for flexible connections between fans and ducts.  
2. Refer to the Section on Equipment Supports for equipment foundation pads.

1.3 SUBMITTALS

- A. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Amber Booth  
B. Kinetics  
C. Mason  
D. Korfund  
E. VSI.  
F. Vibration Eliminator Co., Inc.  
G. Metraflex

2.2 ISOLATOR TYPES

- A. Neoprene mountings shall have a minimum static deflection of 0.35 inches (9mm). All metal surfaces shall be neoprene covered and have friction pads both top and bottom. Bolt holes shall be provided on the bottom and a tapped hole and cap screw on top. Steel rails shall be used above the mountings under equipment such as small vent sets to compensate for the overhang.
- B. Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32mm) thick neoprene elements at the top and a steel spring with general characteristics as in specification B seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. In order to maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the cup bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability.

2.3 ISOLATOR APPLICATION

EQUIPMENT	ISOLATOR TYPE	MINIMUM DEFLECTION
Air Handling Units	A	0.35
In-Line Fans	B	0.5"

PART 3 - EXECUTION

3.1 INSTALLATION

- A. Stock Requirements. The isolation manufacturer's representative shall maintain an adequate stock

VIBRATION ISOLATION

of springs and isolators of type used so that changes required during construction and installation can be made.

- B. Factory Representation. After installation, furnish factory-trained representative of the isolation manufacturer to check various isolators and report measured versus anticipated deflection on all isolators. Have the representative certify that isolators have been installed in accordance with manufacturer's recommendations and approved submittals. Provide written report to Engineer indicating compliance prior to final acceptance.

END OF SECTION

SECTION 23 05 93

TESTING, BALANCING AND ADJUSTING (TAB) OF ENVIRONMENTAL SYSTEMS

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Balance, adjust and test the air distribution system including the exhaust system.
- B. Balance, adjust and test the hydronic system.
- C. Verify and record the duct test results performed by the mechanical contractor.

1.2 RELATED SECTIONS

- A. COORDINATION OF TESTING AND BALANCING

1.3 PAYMENT PROCEDURES

- A. The work of this Section of the Specifications shall be paid directly by the Owner.

1.4 SUBMITTALS

- A. History of the TAB organization.
- B. Agency certification.
- C. Personnel qualifications.
- D. TAB data forms.
- E. Instrumentation list.
- F. Name of the project supervising engineer.
- G. Name and address and contact person of five successfully completed projects of similar size and scope.
- H. To perform required professional services, the balancing agency shall have a minimum of one test and balance engineer certified by the Associated Air Balance Council.

1.5 TAB FIRM QUALIFICATIONS

- A. The organization performing the work shall be a Certified member in good standing of the (AABC) Associated Air Balance Council.
- B. Able to furnish evidence of having contracted for and completed not less than five systems of comparable size and type that have served their Owners satisfactorily for not less than five years.
- C. A specialist in this field and have the personnel, experience, training, skill, and the organization to perform the work.
- D. The balancing agency shall furnish all necessary calibrated instrumentation to adequately perform the specified services. An inventory of all instruments and devices in possession of the balancing agency may be required by the engineer to determine the balancing agency's performance capability.
- E. The balancing agency shall have operated for a minimum of five years under its current name.
- F. Personnel:
  - 1. The project supervisor shall be a Professional Engineer registered in Texas.

TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS

- a. Extensive knowledge of the work involved.
  - b. At least five years experience conducting tests of the type specified.
  - c. This test and balance engineer shall be responsible for the supervision and certification of the total work herein specified.
2. All work shall be conducted under the direct supervision of the supervising engineer.
3. Technicians shall be trained and experienced in the work they conduct.

#### 1.6 WARRANTY

- A. Provide (AABC) guarantee in writing.
- B. Extended warranty.
  1. Include an extended warranty of 2 years after completion of test and balance work, during which time the Architect/Engineer may request a retest or resetting of any outlet or other items as listed in the test report.
  2. Provide technicians and instruments to assist the Architect/Engineer in making any tests he may require during this period.
  3. The balancing agency shall perform an inspection of the HVAC system during the opposite season from that which the initial adjustments were made. The balancing agency shall make any necessary modifications to the initial adjustments to produce optimum system operation.

#### PART 2 - PRODUCTS - NOT USED

#### PART 3 - EXECUTION

##### 3.1 TAB TOLERANCES

- A. The water, outside air, supply air, return air, and exhaust air for each system shall be adjusted to within +/- 5% of the value scheduled on the drawings.

##### 3.2 SITE VISITS

- A. During construction, the balancing agency shall inspect the installation of the piping systems, sheetmetal work, temperature controls, energy management system, and other component parts of the heating, ventilating, and air conditioning systems. One inspection shall take place when 60% of the ductwork is installed and another inspection shall take place when 90% of the equipment is installed. The balancing agency shall submit a brief written report of each inspection to the architect and engineer.
- B. Upon completion of the installation and start-up of the mechanical equipment by the mechanical contractor, the balancing agency shall test and balance the system components to obtain optimum conditions in each conditioned space of the building. If construction deficiencies are encountered that preclude obtaining optimum conditions, and the deficiencies cannot be corrected by the mechanical contractor within a reasonable period of time, the balancing agency shall cease testing and balancing services and advise the architect, engineer, general contractor and owner, in writing, of the deficiencies.
- C. Note proper piping installation, location of valves, and flow measuring instruments.
- D. Make one series of visits, phased as required by construction progress, prior to installation of the ceiling. Note proper installation of balancing dampers.
- E. Continue the site visits up to completion of project. In each succeeding report, list corrections made from previous reports.

##### 3.3 TESTING INSTRUMENTS

- A. Submit a list of all instruments to be used for the test and balance procedures.
  1. Catalog sheets
  2. Certificate of last calibration
  3. Calibration within a period of six months prior to balancing

#### TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS



- B. Testing equipment shall be in good working order and tested for accuracy prior to start of work.

### 3.4 COORDINATION WITH OTHER SPECIFICATION SECTIONS

- A. Review the related ductwork shop drawings and piping shop drawings. Make recommendations concerning suitability with respect to the testing, balancing and adjusting work.
- B. Make tests to verify proper placement of the static pressure sensors for the variable air volume fan system control.
- C. In cooperation with the work specified in Building Management and Control System section, a systematic listing of the testing and verification shall be included in the final TAB report. The TAB firm shall provide a laptop computer to operate with the Building Management and Control System. Building Management and Control System shall provide all necessary software and special interface cables, as required, to communicate with the DDC system:
1. Work with the temperature control contractor to ensure the most effective total system operation within the design limitations, and to obtain mutual understanding of the intended control performance.
  2. Verify that all control devices are properly connected.
  3. Verify that all dampers, valves, and other controlled devices, are operated by the intended controller.
  4. Verify that all dampers and valves are in the position indicated by the controller (open, closed or modulating).
  5. Verify the integrity of valves and dampers in terms of tightness of close-off and full open positions. This includes dampers in multizone units, terminal boxes and fire/smoke dampers.
  6. Observe that all valves are properly installed in piping system in relation to direction of flow and location.
  7. Observe the calibration of all controllers.
  8. Verify the proper application of all normally opened and normally closed valves.
  9. Observe the locations of all thermostats and humidistats for potential erratic operation from outside influences such as sunlight, drafts or cold walls.
  10. Observe the location of all sensors to determine whether their position will allow them to sense only the intended temperatures or pressures of the media. Control contractor will relocate as deemed necessary by the Engineer.
  11. Verify that the sequence of operation for any control mode is in accordance with the approved shop drawings and specifications. Verify that no simultaneous heating and cooling occurs.
  12. Verify the correct operation of all interlock systems and installation is per the manufacturer recommendations.
  13. Check all dampers for free operation.
  14. Verify that all controller setpoints meet the design intent.
  15. Perform variable volume system verification to assure the system and its components track with changes from full flow to minimum flow.
- D. Upon completion of the testing and balancing, submit three days prior notice that the systems are ready for a running test. A qualified representative of the test and balance organization shall be present, with a representative from the engineers office, to field verify TAB report readings. Specific and random selections of data recorded in the certified test and balance report will be reviewed.

### 3.5 INSTRUMENT TEST HOLES

- A. When it is required to make holes in the field to measure temperature, static pressure or velocity in the ducts:
1. Drill holes, plug and tape external duct insulation.
  2. Repair damaged insulation to Engineer's approval.

### 3.6 TESTING THE AIR DISTRIBUTION SYSTEM

- A. The TAB agency shall verify that all ductwork, dampers, grilles, registers, and diffusers have been installed per design and set full open. The TAB agency shall perform the following TAB procedures

## TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS

in accordance with the AABC National Standards and all results shall be recorded in the TAB report:

1. Supply Fans:
    - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
    - b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
    - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main supply and return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
    - d. Outside Air: Test and adjust the outside air on applicable equipment using a Pitot-Tube traverse. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. If a traverse is not practical, use the mixed air temperature method, if the inside and outside temperature difference is at least 20°F, or use the difference between Pitot-tube traverse of the supply and return ducts.
    - e. Static Pressure: Test and record system static pressure, including the static pressure profile of each supply fan.
  2. All Other Fans:
    - a. Fan speeds: Test and adjust fan RPM to achieve design CFM requirements.
    - b. Current and Voltage: Test and record motor voltage and amperage, and compare data with the nameplate limits to ensure fan motor is not in or above the service factor.
    - c. Pitot-Tube Traverse: Perform a Pitot-Tube traverse of the main return ducts, as applicable, to obtain total CFM. If a Pitot-Tube traverse is not practical, an explanation of why a traverse was not made must appear on the appropriate data sheet. Measurements must be recorded with an Inclined Manometer or an Inclined/Vertical Manometer.
    - d. Static Pressure: Test and record system static pressure, including the static pressure profile of each return fan.
  3. VAV Terminal Units:
    - a. Set and record volume regulators on all terminal boxes to meet design maximum and minimum CFM requirements.
    - b. Identification: Identify the type, location, and size of each terminal unit. This information must be recorded on the terminal box data sheets.
  4. Diffusers, Registers and Grilles:
    - a. Tolerances: Test, adjust, and balance each diffuser, grille, and register to within 5% of design requirements. Minimize drafts. Observe throws are in direction as indicated on drawings.
  5. Coils (including electric coils):
    - a. Air Temperature: Once air flows are set to acceptable limits, take wet bulb (cooling coil only) and dry bulb air temperatures on the entering and leaving side of each coil. Calculate the sensible and latent (cooling coil only) capacity of the coil. Provide information in TAB report.
- B. Record preliminary air handler data, including fan RPM and static pressures across filter, fans and coils.
- C. Perform a velocity traverse of the main supply ducts using a pitot-tube and inclined manometer to establish initial air delivery. Perform a Pitot-tube traverse of main supply and return ducts, as applicable, to obtain total CFM. If a pitot-tube traverse is not practical, a detailed explanation of why a traverse was not made must appear on the appropriate data sheet.
- D. Where air measuring stations are installed, use pitot tube traverse readings to verify and record the correct calibration of the stations output.
- E. Make adjustments in fan RPM and damper settings, as required, to obtain design supply air, return air, and outside air.
- F. Measure and adjust all supply and return branches to design air delivery.

#### TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS

- G. Measure and adjust all diffusers to design air delivery to +/- 5% of design requirements.
- H. Make a set of recordings showing final system conditions.

### 3.7 TESTING THE HYDRONIC SYSTEMS

- A. The TAB agency shall, as applicable, verify that all hydronic equipment, piping, and coils have been filled and purged; that strainers have been cleaned; that water has been flushed and is in a clean condition, and that all balancing valves (except bypass valves) are set full open. As applicable, check air vents and expansion or compression tank for proper operation. The TAB agency shall perform the following testing and balancing functions in accordance with the AABC National Standards and all results shall be recorded in the TAB report:
  - 1. Record preliminary pump data.
    - a. Pump RPM.
    - b. Pump shut-off differential head.
    - c. Pump operating differential head.
    - d. Check and verify pump alignment.
    - e. Verify impeller diameter.
- B. Adjust balancing valves in the pump discharge lines to obtain design water quantity as read from the manufacturer's pump curve and from a flow meter.
- C. In variable flow systems, the water flow of the pump shall be set at the scheduled gpm, not the total of all the valves. Determine the diversity of the system and balance the individual coils with the maximum pump water quantity flowing in the system.
- D. Balance flow through:
  - 1. Chillers.
  - 2. Coils.
  - 3. Boiler.
  - 4. Pumps
  - 5. Condensers.
  - 6. Cooling tower.
  - 7. Heat Exchanger.
- E. Use flow meters, differential pressures and temperature relationships as required.
- F. Balance by-pass lines to obtain the same pressure drop with systems on by-pass as full flow through the coil including the valve.
- G. Repeat steps, as required, to obtain a final systems balance and make a set of recordings showing final systems conditions.
- H. Coils:
  - 1. Tolerances: Test, adjust, and balance all chilled water and hot water coils within 5% of design flow requirements.
  - 2. Verification: Verify the type, location, final pressure drop and water quantity (GPM) of each coil. Calculate the actual capacity of all coils. This information shall be recorded on coil data sheets.

### 3.8 EQUIPMENT POWER READINGS

- A. Record the following information for each motor:
  - 1. Equipment designation.
  - 2. Manufacturer.
  - 3. Unit model number and serial number and frame.
  - 4. Motor nameplate horsepower; nameplate voltage; phase and full load amperes.
  - 5. Heater coil in starter.
    - a. Rating in amperes.
    - b. Manufacturer's recommendation.
  - 6. Motor RPM/driven equipment RPM.

### TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS

7. Power reading (voltage, amperes of all legs at motor terminals).

### 3.9 TAB REPORT

- A. The activities described in this specification shall be recorded in a report form; and four individually bound copies shall be provided to the Architect and Engineer. Neatly type and arrange data. Include with the data the date tested, personnel present, weather conditions, nameplate record of the test instruments used and list all measurements taken after all corrections are made to the system. Record all failures and corrective action taken to remedy any incorrect situation. The intent of the final report is to provide a reference of actual operating conditions for the Owner's operations personnel. Provide a "Preface" which shall include a general discussion of the system and any abnormalities or problems encountered.
- B. All measurements and recorded readings (of air, water, electricity, etc.) that appear in the report must have been recorded on site by the permanently employed technicians or engineers of the TAB firm.
- C. Submit reports on forms approved by the engineer that will include the following data as a minimum:
  1. Title Page
    - a. Company Name
    - b. Company Address
    - c. Company telephone number
    - d. Project name
    - e. Project location
    - f. Project Manager
    - g. Project Engineer
    - h. Project Contractor
    - i. Project Identification Number
  2. Summary of the TAB report data
  3. Index
  4. Instrument List
    - a. Instrument
    - b. Manufacturer
    - c. Model
    - d. Serial Number
    - e. Range
    - f. Calibration Date
    - g. What test instrument is to be used for:
  5. Fan Data
    - a. Location
    - b. Manufacturer
    - c. Model
    - d. Air flow, specified and actual
    - e. Total static pressure (total external) specified and actual
    - f. Inlet pressure
    - g. Discharge pressure
    - h. Fan RPM
  6. Return Air/Outside Air Data
    - a. Identification/location
    - b. Design return air flow
    - c. Actual return air flow
    - d. Design outside air flow
    - e. Actual outside air flow
    - f. Return air temperature
    - g. Outside air temperature
    - h. Required mixed air temperature
    - i. Actual mixed air temperature
  7. Electric Motors
    - a. Manufacturer
    - b. HP/BHP
    - c. Phase, voltage, amperage, nameplate, actual

#### TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS

- d. PM
- e. Service Factor
- f. Starter size, heater elements, rating
- 8. V-Belt Drive
  - a. Identification/location
  - b. Required driven RPM
  - c. Drive sheave, diameter and RPM
  - d. Belt, size and quantity
  - e. Motor sheave, diameter and RPM
  - f. Center-to-center distance, maximum, minimum and actual
- 9. Duct Traverse
  - a. System zone/branch
  - b. Duct size
  - c. Area
  - d. Design velocity
  - e. Design air flow
  - f. Test velocity
  - g. Test air flow
  - h. Duct static pressure
  - i. Air correction factor
- 10. Air Monitoring Station Data
  - a. Identification/location
  - b. System
  - c. Size
  - d. Area
  - e. Design velocity
  - f. Design air flow
  - g. Test velocity
  - h. Test air flow
- 11. Air Distribution Test Sheet
  - a. Air terminal number
  - b. Room number/location
  - c. Terminal type
  - d. Terminal size
  - e. Correction factor
  - f. Design velocity
  - g. Design air flow
  - h. Test (final) velocity
  - i. Test (final) air flow
- 12. Pump Data
  - a. Identification/number
  - b. Manufacturer
  - c. Size/model
  - d. Impeller
  - e. Service
  - f. Design flow rate, pressure drop, BHP
  - g. Actual flow rate, pressure drop, BHP
  - h. Discharge pressure
  - i. Suction pressure
  - j. Total operating head pressure
  - k. Shut off, discharge and suction pressures
  - l. Shut off, total head pressure
  - m. Pressure differential settings
- 13. Cooling Coil Data
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Entering air DB temperature, design and actual
  - f. Entering air WB temperature, design and actual
  - g. Leaving air DB temperature, design and actual
  - h. Leaving air WB temperature, design and actual

TESTING AND BALANCING (TAB) OF ENVIRONMENTAL SYSTEMS

- i. Water pressure flow, design and actual
- j. Water pressure drop, design and actual
- k. Entering water temperature, design and actual
- l. Leaving water temperature, design and actual
- m. Air pressure drop, design and actual
- n. Capacity - sensible and latent
- 14. Heating Coil Data
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Entering air DB temperature, design and actual
  - f. Leaving air DB temperature, design and actual
  - g. Water pressure flow, design and actual
  - h. Water pressure drop, design and actual
  - i. Entering water temperature, design and actual
  - j. Leaving water temperature, design and actual
  - k. Air pressure drop, design and actual
  - l. Capacity
- 15. Electric Coil Data
  - a. Identification/number
  - b. Location
  - c. Service
  - d. Manufacturer
  - e. Entering air DB temperature, design and actual
  - f. Leaving air DB temperature, design and actual
  - g. Electrical Characteristics
  - h. Capacity
- 16. Sound Level Report
  - a. Location (Location established by the design engineer)
  - b. N C curve for eight (8) bands-equipment off
  - c. N C curve for eight (8) bands-equipment on
- 17. Vibration Test on equipment having 10 HP motors or greater in size.
  - a. Location of points:
    - 1) Fan bearing, drive end
    - 2) Fan bearing, opposite end
    - 3) Motor bearing, center (if applicable)
    - 4) Motor bearing, drive end
    - 5) Motor bearing, opposite end
    - 6) Casing (bottom or top)
    - 7) Casing (side)
    - 8) Duct after flexible connection (discharge)
    - 9) Duct after flexible connection (suction)
  - b. Test readings:
    - 1) Horizontal, velocity and displacement
    - 2) Vertical, velocity and displacement
    - 3) Axial, velocity and displacement
  - c. Normally acceptable readings, velocity and acceleration
  - d. Unusual conditions at time of test
  - e. Vibration source (if non-complying)
- 18. Control verification indicating date performed and any abnormalities identified.
  - a. Point Location/Description
  - b. EMS Readout (Setpoint and Actual)
  - c. Actual Readout of all points
  - d. Interlocks
  - e. Safeties
  - f. Variable speed drive tracking with EMS input
  - g. Variable speed drive Bypass operation
  - h. Sequence of operation

END OF SECTION

SECTION 23 05 94

COORDINATION OF TESTING AND BALANCING

PART 1 - TESTING, BALANCING AND ADJUSTING

1.1 WORK INCLUDED

- A. Balancing and adjusting of the environmental systems is specified in Section 23 05 93.
- B. Coordination of the work is specified in this Section.

PART 2 - PRODUCTS / NOT USED

PART 3 - EXECUTION

3.1 COORDINATION

- A. Bring the work to a state of readiness for testing, balancing, and adjusting.
  - 1. Install air terminal devices.
  - 2. Provide specified filters in air handling equipment. Install clean filters just prior to the start of the test and balance work.
  - 3. Verify lubrication of equipment.
  - 4. Install permanent instrumentation.
  - 5. Clean piping systems and fill with clean water.
  - 6. Complete "Start-up" of equipment.
  - 7. Check rotation and alignment of rotating equipment and tension of belted drives.
  - 8. Verify ratings of overload heaters in motor starters.
  - 9. Verify that safety and operating control set points are as designed and automatic control sequences have been checked.
  - 10. Provide control diagrams and sequence of operation.
  - 11. Collect material for maintenance manuals and prepare one manual especially for use in testing and balancing.
  - 12. Verify that graphic operational data such as start/stop instructions, valve tag schedules, and piping identification schedules have been provided where needed.
  - 13. Verify that equipment and piping identification work has been completed with valve tags, schedules, and piping identification system.
  - 14. Comb out fins on extended-surface heat transfer coils where damaged.
  - 15. Clean all strainers as required.
  - 16. Remove construction strainers after water is cleaned and treated.
  - 17. Remove all temporary filters from HVAC equipment.
  - 18. Provide start-up reports listing all start-up information and manufacturer's information attached.
- B. Provide and install new pulleys and belts as required to effect the correct speed ratio. Adjustments where no belt or pulley change is required, is specified in Section 23 05 93.
- C. Verify that the systems are ready for balancing and adjusting.
- D. Submit a letter stating:
  - 1. The specified pieces of equipment have been checked, started, and adjusted by the manufacturer.
  - 2. Other equipment has been checked and started.
  - 3. The systems have been operated for the specified period of time.
  - 4. The automatic controls system has been adjusted, calibrated, and checked, and is operating as specified.
- E. Provide the services of a technician full time at all times at the project when testing, balancing and adjusting work is being conducted.
- F. Provide instrumentation and services to take readings of the required data for the refrigerant circuits.

COORDINATION OF TESTING AND BALANCING

- G. Provide and install volume dampers required for balancing by the TAB Contractor.

3.2 START-UP OF EQUIPMENT

- A. Pre-start & Start-up equipment using the procedures as recommended by the manufacturers.
- B. Complete start-up of equipment prior to start of testing & balancing.
- C. Submit start-up procedures as outlined by the manufacturers and complete the "HVAC FAN / AIR HANDLING / START-UP REPORT FORM" to Engineer.



## HVAC FAN / AIR HANDLING UNIT / START-UP REPORT FORM

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END OF SECTION

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SECTION 23 07 13

EXTERNAL DUCT INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install external insulation on supply, return, exhaust and outside air ductwork.
- B. External insulation of concealed and exposed ducts is included in this Section. Internal acoustic duct lining is specified under ductwork and not included in this Section.

1.2 RELATED WORK

- A. Division 9 - FINISHES. Painting and Color Coding.
- B. Division 23 - MECHANICAL.
  - 1. Air Handling Units. Internal insulation for air units is specified in the sections on air handling units. The units do not require external insulation.
  - 2. Internal Duct Liner. Internal duct liner is specified in the section on ductwork.
  - 3. Insulation. Refer to specific sections on individual insulation types.
  - 4. Refer to insulation and liner plan detail.

1.3 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship, resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
- C. All duct insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50 as determined by test procedures ASTM E84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated system is not approved.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated ductwork or other services are tapped, remove existing insulation back to undamaged sections and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.4 APPROVALS

- A. Submittals. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in Division 1 General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location, and the manufacturer's installation instructions for each product.
- B. Sample Application. Make an application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with

EXTERNAL DUCT INSULATION

installation of the work.

## PART 2 - PRODUCTS

### 2.1 INSULATION

- A. Glass fiber rigid duct insulation.
  - 1. Minimum density of 3 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.7 mil aluminum foil reinforced with glass yarn mesh and laminated to 40 lbs. fire-resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
  - 2. Acceptable Manufacturers
    - a. Schuller 814 spin-glas FSK.
    - b. Owens-Corning Type 703 board RKF.
    - c. Knauf 3 PCF FSK.
- B. Glass fiber blanket duct insulation.
  - 1. Minimum density of 1.0 pcf, installed R value to be 6.0 (when located in a conditioned plenum) and minimum density of 0.75 pcf, installed R value to be 8.0 (when located in an unconditioned plenum) at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs. fire resistant Kraft. R-value to be indicated on exterior side of insulation to be verified by City inspector.
  - 2. Acceptable Manufacturers
    - a. Manville R-series Microlite FSKL.
    - b. Owens-Corning ED100 RKF.
    - c. Knauf 1.0 PCF FSK.
- C. Fiberglass reinforcing cloth mesh.
  - 1. Acceptable Manufacturers
    - a. Perma Glass Mesh.
    - b. Alpha Glass Mesh.
    - c. Childers Chil-Glas #10
    - d. Foster Mast a Fab
    - e. Vimasco.
- D. Mastics, sealants, coatings and adhesives.
  - 1. Acceptable Manufacturers
    - a. Childers.
    - B. Foster.
    - c. Vimasco.
- E. Fireboard Insulation
  - 1. Totally encapsulated with foil facing.
  - 2. Two hour rated fire protection.
  - 3. Zero clearance to combustible protection.
  - 4. System shall be listed and labeled by an NRTL.
  - 5. Tested per ISO 6944, Type A Duct and achieve a 2 hour rating for stability, integrity and insulation.
  - 6. Provided system is subject to the approval of the Local Authority Having Jurisdiction.
  - 7. Acceptable Manufacturers
    - a. Unifrax ON Fyrewrap Elite 1.5
    - b. Partak Insulation, Inc. Paroc Fireboard
    - c. Thermal Ceramics FireMaster 3M
    - d. Premier Refractories International, Pyroscat.
- F. Rigid Closed Cell Insulation
  - 1. Acceptable Manufacturers
    - a. Dow Trymer.
    - b. Phenolic Foam.
- G. Reinforced Foil Tape
  - 1. Acceptable Manufacturers

- a. Venture 1525CW
- b. 3" FSK
- 2. Thickness 6.5 mils
- 3. Color: silver

## 2.2 COATING AND ADHESIVE

- A. Coating. Provide Childers CP-38 or Foster 30-80 vapor barrier coating. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. Outdoors: Provide as insulation coating Childers Encacel X or Foster Monolar 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249.
- C. Adhesive. Provide Childers CP-82 or Foster 85-20 vapor barrier adhesive.
- D. Reinforcing Mesh. Provide 10 x 10 white glass or polyester reinforcing mesh.

## 2.3 OUTDOOR DUCT LAMINATED JACKETING

- A. Rubberized bitumen compound material:
  - 1. Ultraviolet resistant
  - 2. Weatherproof
  - 3. Vapor retarding jacketing
  - 4. Laminated jacketing
  - 5. Cross-laminated high strength polyethylene film
  - 6. Laminated to aluminum foil
  - 7. Minimum 60-mil thickness
- B. Acceptable Manufacturers:
  - 1. Alumaguard 60
  - 2. Flex Clad 400
  - 3. Venture Clad 1577CW

## PART 3 - EXECUTION

### 3.1 FIRE SAFETY REQUIREMENTS

- A. Do not extend duct coverings through walls or floors required to be fire-stopped or required to have a fire resistance rating. Interrupt duct coverings in the immediate vicinity of heat sources such as electric resistance or fuel-burning heater.

### 3.2 CONCEALED DUCT

- A. Provide flexible glass fiber insulation with factory-applied, reinforced UL labeled Foil-Skrim-Kraft (FSK) facing.
- B. Standing Seams. Insulate standing seams and stiffeners, which protrude through the insulation with 0.6 lb. per cubic foot density, 1-1/2" thick, faced, flexible blanket insulation. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork with all circumferential joints butted and longitudinal joints overlapped a minimum of 2". In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on twelve inch centers to prevent sagging of insulation.
- D. On circumferential joint, the 2" flange on the facing shall be stapled with 9/16" outward clinch steel staples on 2" centers and taped using 3" wide foil tape applied with additional adhesive of Foster 85-75. Cover all seams, joints, pin penetrations and other breaks with foil tape and glue.
- E. Ductwork in mechanical rooms is considered concealed spaces.

### 3.3 EXPOSED DUCT INSULATION

- A. Ductwork in exposed locations is to be insulated with fiberglass rigid / semi-rigid board insulation.
  - 1. Apply fabric and mastic to provide a smooth surface for painting.
- B. Standing Seams: Insulate standing seams and stiffeners which protrude through the insulation with 0.6 lb per cubic foot density, 1-1/2 inch thick, faced insulation. As a vapor seal, use reinforcing mesh with vapor barrier coating. Insulation shall not prevent adjustment of damper operators.
- C. Insulation shall be wrapped tightly on the ductwork. Adhere insulation to ductwork with adhesive. In addition, secure insulation to the bottom of rectangular ductwork by the use of either weld pins with washers or cup-head pins welded to the ductwork or perforated based insulation hangers glued to the duct on 12 inch centers to prevent sagging of insulation.
- D. Cover all seams, joints, pin penetrations and other breaks with coating reinforced with reinforcing mesh. Fabric shall not be visible after coating.

### 3.4 OUTDOOR DUCTWORK COVERING

- A. Cover all supply and return ductwork outdoors:
  - 1. 1-1/2" thick, rigid closed cell insulation with reinforced foil facing.
- B. Install a high point in center and slope in both directions so water will not stand on horizontal surfaces.
- C. Impale the insulation over mechanical fasteners and washers.
  - 1. A minimum of 2 rows of fasteners per side on 12-inch centers.
  - 2. Seal all breaks, joints and punctures by applying a 1/8" thick vapor barrier mastic coating, embedded in open mesh reinforcing mesh.
- D. Standing S, or flanged connections shall be covered with the same thickness of insulation overlapped a minimum of 4".
- E. Apply a tack coat of Childers CP-10/11 or Foster 46-50 weather barrier mastic over the entire surface.
  - 1. While this coat is still tacky, Childers #5 glass fiber reinforcing mesh shall be smoothly applied and pressed into the mastic. The cloth shall be taut with adjacent edges overlapped a minimum of 4".
  - 2. After the first coat of mastic has taken its set, the second coat shall be applied over the cloth by palm, trowel, or spray to sufficient thickness that, when dried, the combined thickness of mastic and cloth is not less than 1/8".
  - 3. Upon completion, the openings in the cloth shall be completely sealed and the yarn shall not be visible. The completed work shall be completely smooth and present a plane surface.
  - 4. Aluminum gray or white finish as approved by the Architect.
- F. Standing water on horizontal surfaces is not approved.
- G. Apply outdoor duct laminated jacketing protection over entire insulation surface. Apply rubberized bitumen compound, applied to a cross-laminated high strength polyethylene film, laminated to aluminum foil.

### 3.5 KITCHEN GREASE EXHAUST DUCTWORK / KILN DUCTWORK / FUME HOOD DUCT

- A. Secure fireboard insulation to duct with impaling pins and 3" square speed clips. In addition, provide a wire mesh support system and additional sealing or support as required by the code enforcing authority. The insulation support system shall include framed access to allow the insulation to be removed and replaced without damage at the access doors in the duct system for inspection and cleaning. Coordinate location of access openings to correspond accurately. Provide stainless steel banding on 12" centers.

### 3.6 GENERAL INSTALLATION

- A. Install materials in accordance with manufacturer's instructions.
- B. Apply insulation on clean, dry surfaces only.
- C. Continue insulation with vapor barrier through penetrations.
- D. Neatly finish insulation at supports, protrusions and interruptions.
- E. Install insulation on clean, dry surfaces, and only after building is weatherproofed sufficiently to preclude any rainwater on insulation.
- F. Apply mastic over the fiberglass reinforcing mesh to a thickness where fabric is not visible after completion.
- G. Install fiberglass blanket duct insulation on top of supply air grilles not fire rated.

END OF SECTION

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SECTION 23 07 19

HVAC PIPING INSULATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install piping insulation, jackets, accessories and covering of specified materials. The insulation shall be used for high and low temperature piping applications including chilled water, hot water and condensate piping.

1.2 QUALITY ASSURANCE

- A. The intent of insulation specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide insulation in accordance with the specifications for each type of service and apply as recommended by the manufacturer and as specified.
- B. An approved contractor for this work under this Division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that have served their owners satisfactorily for not less than 3 years.
- C. All piping insulation used on the project inside the building must have a flame spread rating not exceeding 25 and a smoke developed rating not exceeding 50, as determined by test procedures ASTM E 84, NFPA 255 and UL 723. These ratings must be as tested on the composite of insulation, jacket or facing, and adhesive. Components such as adhesives, mastics and cements must meet the same individual ratings as the minimum requirements and bear the UL label.
- D. Condensation on any insulated piping system is not acceptable.
- E. Replace insulation damaged by either moisture or other means. Insulation that has been wet, whether dried or not, is considered damaged. Make repairs where condensation is caused by improper installation of insulation. Also repair any damage caused by the condensation.
- F. Where existing insulated piping, or other surfaces are tapped, remove existing insulation back to undamaged sections for hot surfaces or to nearest insulation stop for cold surfaces, and replace with new insulation of the same type and thickness as existing insulation. Apply as specified for insulation of the same service.

1.3 SUBMITTALS

- A. Submit product data on each insulation type, adhesive, and finish to be used in the work. Make the submittal as specified in General Requirements and obtain approval before beginning installation. Include product description, list of materials and thickness for each service and location and the manufacturer's installation instructions for each product.
- B. Make a field application of each type of insulation to display the material, quality and application method. Obtain approval of the sample application before proceeding with installation of the work.

1.4 RELATED WORK

- A. Finishes. Painting and color-coding
- B. Pipe Heat Tracing

PART 2 PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

HVAC PIPING INSULATION

- A. Glass fiber pipe insulation:
  - 1. Johns-Manville Micro-Lok AP-T
  - 2. Owens-Corning ASJ/SSL
  - 3. Knauf ASJ/SSL
- B. Cellular Glass Insulation (Foamglass):
  - 1. Pittsburg Corning
  - 2. Cell-U-Foam
- C. Rigid Foam Insulation:
  - 1. Kingsapan Tarec
  - 2. Dow Trymer
  - 3. Tarec Ecophen – Phenolic Foam
- D. Aluminum Jacketing:
  - 1. ITW Lock-on (Childers)
  - 2. ITW Z-lock (Pabco)
- E. Fiberglass reinforcing cloth mesh:
  - 1. Perma Glass Mesh
  - 2. Alpha Glass Mesh
  - 3. Childers Chil-Glas
  - 4. Foster Mast a Fab
  - 5. Vimasco
- F. Mastics, Sealants, Coatings and Adhesives
  - 1. Childers
  - 2. Foster
  - 3. Vimasco
  - 4. Armacell 520 Adhesive
- G. Elastomeric Insulation
  - 1. Armacell
- H. Weather Resistant Coating
  - 1. WB Armaflex Finish
  - 2. Foster 30-64
- I. Glass fiber blanket insulation
  - 1. Manville R-series Microlite FSKL
  - 2. Owens-Corning eD75 or ED100 RKF
  - 3. Knauf 0.75 PCF FSK

## 2.2 RIGID FOAM PIPE INSULATION

- A. Polyisocyanurate pipe insulation or phenolic foam pipe insulation, with all service reinforced vapor barrier jacket having integral laminated vapor barrier.
  - 1. Polyisocyanurate: Thermal conductivity 0.14 @ 75°F mean (ASTM C518).
  - 2. Phenolic Foam: Thermal conductivity 0.13 @ 75°F mean (ASTM C 518); minimum 2.5# density.
  - 3. Polyisocyanurate is not to be used inside of buildings without 25/50 rating.

## 2.3 FIBERGLASS PIPE INSULATION

- A. Heavy density, dual temperature fiberglass insulation with factory applied, all service, reinforced vapor barrier jacket having integral laminated vapor barrier. Provide with a factory applied pressure sensitive tape closure system and matching butt strips. Supply in thickness as shown.
  - 1. Thermal conductivity 0.23 @ 75°F mean (ASTM 335).

## 2.4 ELASTOMERIC INSULATION

- A. Insulation material shall be flexible, closed-cell elastomeric insulation in tubular or sheet form. Material shall have a flame spread rating of 25 or less and a smoke developed rating of 50 or less when tested in accordance with ASTM E84, latest revision. Sheet material with a thickness greater than  $\frac{3}{4}$ " shall have a flame spread rating of 25 or less and a smoke developed rating of 100 or less when tested in accordance with ASTM E84, latest revision. In addition, the product, when tested, shall not melt or drip flaming particles, and the flame shall not be progressive. In addition, all materials shall pass simulated end-use fire test.

1. Thermal conductivity 0.27 at 75°F mean (ASTM C177 or C518)

## 2.5 CELLULAR GLASS INSULATION

- A. ASTM C552:

1. "k" value of 0.35 @ 75°F ("ksi" value of 0.047 @ 24°C);  
2. 8.0 lb/cu.ft. (128 kg/cu.m.) density

## 2.6 INSULATION/SHIELD AT HANGERS

- A. Field fabricated: Use 360° sections of rigid foamglass insulation that will support the bearing area at hangers and supports. Further support insulation at hangers and supports with a shield of galvanized metal covering at least half of the pipe circumference, and conforming to the schedule. Insulation shall extend at least 1" beyond metal shield on each end. When pipe is guided at top and bottom, metal shields shall cover the whole pipe circumference. Adhere metal shield to insulation so that metal will not slide with respect to insulation with  $\frac{1}{2}$ " aluminum bands (2) per shield.

1. Sections of foam glass insulation may be used of the same outside diameter of the adjoining pipe insulation.  
2. Minimum thickness of foam glass insulation shall not be less than 1" thick.

- B. Pipe saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter or more than 22". Provide 18 gauge through 4" pipe and 16-gauge 5" pipe and above.

## 2.7 SEALANT, ADHESIVE AND FINISH

- A. Lap Adhesive. Provide Childers CP-82 or Foster 85-20 adhesive.

- B. Vapor Barrier Finish:

1. Indoors: Provide as insulation coating Childers CP-38 or Foster 30-80, white. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.  
2. Outdoors: Provide as insulation coating Childers Encacel X or Foster 60-90. Permeance shall be 0.03 perms or less at 30 mils dry. Tested at 100°F and 90% RH per ASTM F 1249 and must be Hypalon rubber based.  
3. Underground: Provide Childers CP-22/24 or Foster 60-25/26 for fittings and areas. Pittwrap cannot be used.

- C. Insulation Joint Sealant. Provide Childers CP-76 or Foster 95-50 vapor barrier sealant.

- D. Metal Jacketing Sealant. Provide Childers CP-76 or Foster 95-44 metal jacketing sealant for all outdoor metal jacketing laps.

- E. Lagging Adhesive. Provide Childers CP-50AMV1 or Foster 30-36.

- F. Other products of equal quality will be acceptable only upon approval.

## 2.8 ALUMINUM JACKETING

- A. Finish insulated piping outdoors with a smooth prefabricated Z-lock aluminum jacket 0.016" thick with factory applied 1 mil polyethylene/40 lb and Fab strap. Kraft moisture barrier.

- B. Valves, Fittings and Flanges. For finishing valves, fittings, flanges and similar installations, provide formed aluminum covers, 0.024" thick.

## HVAC PIPING INSULATION

- C. Straps and Seals. Provide 1/2" x 0.020 stainless steel strapping and seals for jackets and covers according to manufacturer's recommendations.

## 2.9 GLASS FIBER BLANKET INSULATION

- A. Minimum density of 1.0 PCF, 2" thick, installed R value to be 6.0 or better at 75°F mean, facing of 0.35 mil foil reinforced with glass yarn mesh and laminated to 40 lbs fire resistant kraft.

## PART 3 - EXECUTION

### 3.1 INTERIOR PIPING

- A. Cover all hot water piping with glass fiber, heavy density, dual temperature pipe insulation with a vapor barrier jacket. Apply insulation to clean, dry pipes. Longitudinal seams shall be joined firmly together and sealed with self-sealing lap joints. Butt insulation joints firmly together and seal with a 3" wide ASJ butt strip seal. Longitudinal seams and butt strip laps shall be coated and sealed with CP-38 or Foster 30-80 vapor barrier coating.
- B. Cover all chilled water piping with rigid foam insulation.
  - 1. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
  - 2. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using CP-82 adhesive. Secure fitting insulation covers and segments in place with 1/2" wide glass filament tape.
  - 3. Apply a tack coat of fitting mastic over the insulation and tape.
  - 4. Neatly embed with 10 x 10 fiberglass cloth into the tack coat.
  - 5. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
  - 6. Seal ends of pipe insulation with vapor barrier mastic at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- C. Install hanger with protective shield, on the outside of all insulation.
- D. Where domestic water pipes (1/2" & 3/4" pipe sizes) are installed on trapeze type hangers, provide galvanized sheet metal protection shields at these locations. Place insulation jacket directly on hanger. Incompressible, load bearing insulation segments are not required.
- E. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter. Provide 18-gauge through 4" pipe and 16-gauge for 5" pipe and above.
- F. **Seal ends of pipe for chilled water insulation with vapor barrier mastic at valves, flanges, fittings, and a minimum of every 9' on straight runs of piping at the seams. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe making a complete seal.**
- G. Apply a smooth flood coat of white lagging adhesive Foster 30-35 or Childers CP-35 over all exposed insulation within mechanical rooms.
- H. Piping to be insulated as specified above:
  - 1. Chilled water and heating water
  - 2. Domestic hot and cold water
  - 3. Make-up water
  - 4. Horizontal sanitary drain piping that receives condensate
  - 5. Exposed to view storm drainage system including roof and overflow drain bodies, vertical piping from drain body to elbow, all horizontal rain leaders, and first elbow turning down

### 3.2 REFRIGERANT AND CONDENSATE PIPING

- A. Cover all pipe with elastomeric insulation by slitting tubular sections or sliding unslit sections over the open ends of piping or tubing. Seams and butt joints shall be adhered and sealed using Foster

## HVAC PIPING INSULATION

85-75, Childers CP-82 or Armstrong 520 Adhesive.

- B. All fittings shall be insulated with the same insulation thickness as the adjacent piping. All seams and mitered joints shall be adhered with Foster 85-75, Childers CP-82 or 520 Adhesive.
- C. Pipe Saddles: Formed galvanized sheets at each support point for insulated pipe, shaped to fit pipe, and covering bottom half of pipe. Length at saddle shall be not less than twice the insulation outside diameter.
- D. Outdoor exposed piping shall be painted with two coats of either WB or SB Armaflex finish or Foster 30-64 elastomer foam coating. All seams shall be located on the lower half of the pipe.
- E. Outdoor exposed piping after being sealed as noted above apply aluminum jacketing to protect piping insulation exposed to weather, from damage from sunlight, moisture, equipment maintenance, wind, and shall provide shielding from solar radiation. Adhesive Tape shall not be permitted.

### 3.3 PIPING OUTDOORS ABOVE GRADE

- A. Insulate all water piping exterior of building above grade with rigid foam insulation and aluminum jacketing.
- B. Adhere the vapor barrier jacket longitudinal seam with vapor barrier adhesive.
- C. Cover all valves, fittings and flanges with factory made molded or field fabricated segments of pipe insulation of a thickness and material equal to the adjoining insulation. Adhere segments together with no voids, using Childers CP-82 or Foster 85-20 adhesive. Secure fitting insulation covers and segments in place with 1/2" wide glass filament tape.
- D. Apply a tack coat of fitting vapor barrier coating over the insulation and tape.
- E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
- F. Apply coating over the fiberglass cloth to a thickness where the mesh is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier coating at valves, flanges, fittings and every 21' on straight runs of piping. Mastic should extend on top of ASJ jacket, across the foam, down onto the pipe, making a complete seal.
- H. Finish with aluminum jacketing as specified.

### 3.4 UNDERGROUND PIPE COVERING

- A. Cover chilled and hot water piping underground with cellular glass insulation.
- B. Butter insulation joints with Childers CP-76 or Foster 95-50 vapor barrier sealant. Secure with stainless steel bands or 1/2" fiberglass reinforced tape on 9" centers.
- C. Cover valves and flanges with fabricated fittings of thickness and material equal to the adjoining insulation. Fasten fittings in place with stainless steel bands or 1/2" fiberglass reinforced tape.
- D. Apply a tack coat of fitting mastic Childers CP-22/24 or Foster 60-25/26 over the insulation and bands.
- E. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
- F. Apply mastic over the fiberglass cloth to a thickness where the fabric is not visible after completion.
- G. Seal ends of pipe insulation with vapor barrier mastic at all valves, fittings, flanges and every 21' on straight run piping. Mastic should extend on top of ASJ jacket, across the glass, down onto the pipe, making a complete seal.

- H. Finish with 125 mil thickness Pittwrap jacket applied in accordance with manufacturer's instructions. At contractor's option, cover insulation with Servi-Wrap P-500 installed in accordance with manufacturer's instructions.

### 3.5 FLANGE, VALVE AND FITTING INSULATION

- A. Cover valves and flanges with fabricated segments, fittings with two-piece factory molded fittings, and both of matching pipe insulation type and thickness equal to that of the adjoining pipe. Fittings and fabricated segments shall be securely held in place.
1. Apply a tack coat of insulating coating/mastic to the insulated fitting to produce a smooth surface.
  2. After mastic is dry, apply a second coat of vapor barrier coating/mastic. Neatly embed with 10 x 10 fiberglass or polyester reinforcing mesh into the tack coat.
  3. Overlap coating/mastic and fiberglass/polyester reinforcing mesh by 2" on adjoining sections of pipe insulation.
  4. Apply a second coat of coating/mastic over the fiberglass/polyester reinforcing mesh to present a smooth surface.
  5. Apply coating/mastic to a wet film thickness of 3/64".
  6. Fabric shall not be visible after completion.
  7. Vapor seal flanges, valves and fittings with Childers CP-38 or Foster 30-80. Coating must meet MIL Spec C-19565C, Type II and be QPL Listed. Permeance shall be 0.013 perms or less at 43 mils dry. Tested at 100°F and 90% RH per ASTM E96.
- B. PVC fitting covers are not acceptable.

### 3.6 ALUMINUM JACKETING (Insulated Piping Outdoors Above Grade)

- A. Apply smooth aluminum jacket on piping, valves, fittings and flange covers according to manufacturer's recommendations, using stainless steel strapping and seals, to provide weather tight covering and to shed water.
- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be sufficient in itself for this function. Lap each adjoining jacket section a minimum of 3" to make a weather tight seal with the application of 1/8" bead of Childers CP-76 or Foster 95-44 metal jacketing sealant.
- C. Install straps on 9" centers and at each circumferential lap joint.
- D. Cover and seal all exposed surfaces.
- E. The use of screws and rivets is not approved.
- F. Provide isolation (30# felt) between the aluminum jacket and the sheetmetal protection shield at each pipe support point.

### 3.7 MISCELLANEOUS

- A. Insulate pumps.
- B. Install materials after piping has been tested and approved.
- C. Apply insulation on clean, dry surfaces only.
- D. Apply weather protective finish on elastomeric insulation installed in non-conditioned spaces. Provide a minimum of three coats.

### 3.8 INSULATION THICKNESS

<u>INSULATED UNIT</u>	<u>THICKNESS (Inches)</u>
Chilled Water Piping (through 2" pipe)	1-1/2
Chilled Water Piping (2-1/2" pipe and Larger)	2

Condensate Drains	1
Heating Water Piping 2" Pipe and Larger	2
Heating Water Piping 1-1/2" Pipe and Smaller	1-1/2

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SECTION 23 09 33

BUILDING MANAGEMENT AND CONTROL SYSTEM

PART 1 - GENERAL

1.1 SCOPE

- A. The existing campus is controlled by an existing Automated Logic Control system installed by UES Houston. All new equipment shall be fully integrated into the existing control system including a completely new graphics package for all new equipment and is a part of this scope. Expansion and modifications to the Building Management and Control System (BMCS), shall include industrial instrumentation necessary to obtain functions and results specified. Also, shall include items such as sensors, valves, dampers, valve and damper operators, DDC panels, relays, terminal equipment controllers, mounting brackets and thermowell, etc. Integrate all components to provide a complete and functioning system.
- B. Temperature Control System components:
  - 1. Electronic instruments as specified
  - 2. Electric instruments as specified
  - 3. Microcomputer instruments as specified
- C. All control devices of the same type of product shall be of a single manufacturer.
- D. Control, power, and interlock wiring necessary to accomplish sequences specified in this Section shall be provided and installed by the Control Subcontractor. Materials and methods of execution as specified in Division 26, Electrical.
  - 1. Coordinate current characteristics of all electrical instruments and equipment with Division 26 of the specifications and related electrical drawings.
- E. The entire Building Management and Control System (BMCS) shall be installed by the Automation System Manufacturer or Authorized Distributor.
  - 1. All components and elements
  - 2. The testing and acceptance procedure
- F. The manufacturer of the building automation system shall provide documentation supporting compliance with ISO-9002 (Model for Quality Assurance in Production, Installation, and Servicing). The intent of this specification requirement is to ensure that the products from the manufacturer are delivered through a Quality System and Framework that will assure consistency in the products delivered for this project.
- G. The entire Building Management and Control System (BMCS) shall be installed, Commissioned, and tested; all performed by the Automation System Manufacturer or Authorized Distributor if approved by engineer.
  - 1. All components and elements.
  - 2. Start-up and point verification.
  - 3. The testing and acceptance procedure.

1.2 RELATED WORK

- A. Division 23, Mechanical
- B. Division 26, Electrical

1.3 SUBMITTALS

- A. Submit items of the Building Management and Control System (BMCS).
  - 1. Temperature control equipment & Field devices.
  - 2. Wiring & Flow diagrams.
  - 3. Sequence of operation.
  - 4. Complete, detailed, control and interlock-wiring diagram.
  - 5. Indicate mechanical and electrical equipment furnished and electrical interlocks, indicating terminal designation of equipment. Respective equipment manufacturers shall

BUILDING MANAGEMENT AND CONTROL SYSTEM

furnish through the Mechanical Contractor, approved drawings of equipment to be incorporated in this diagram.

6. Submit Input / Output summary of all points.
7. Submit an outline of testing procedures from section Testing and Acceptance.
8. Mark up a copy of the specifications for the product. Indicate in the margin of each paragraph the following: "Comply", "Do Not Comply", or "Not Applicable". Explain all "Do Not Comply" statements.
9. Submit sample of space temperature sensor and guards for review prior to purchase or installation.

#### 1.4 COOPERATION WITH OTHER TRADES

- A. Furnish control valves, temperature sensing element wells, flow and pressure sensing devices, dampers, and other similar devices to the Mechanical Contractor in a timely manner for installation under the Building Management and Control System (BMCS), Subcontractor's supervision.

#### 1.5 WARRANTY

- A. Provide with a manufacturer's parts and labor warranty for a period of two years from substantial completion.

### PART 2 - PRODUCTS

#### 2.1 ACCEPTABLE MANUFACTURERS

- A. Automated Logic Branch Office - WebCTRL

#### 2.2 SYSTEM ARCHITECTURE

- A. The Building Management and Control System (BMCS) shall consist of an information-sharing network of stand-alone Direct Digital Control Panels (DDCP) to monitor and control equipment as specified of the control sequence and input/output summary.
- B. "Information sharing" shall be defined as: The function of each DDCP to exchange data on the network trunk with other DDCP's without the need for additional devices such as network managers, gateways, or central computers.
- C. "Stand-alone" shall be defined as: The function of each DDCP to independently monitor and control connected equipment through its own microcomputer.

#### 2.3 COMMUNICATIONS PROCESSING

- A. The BMCS shall operate as a true token-pass peer-to-peer communication network. Resident processors in each DDCP shall provide for full exchange of system data between other DDCP's on the network trunk. Systems that limit data exchange to a defined number of system points are not acceptable.
- B. Systems that operate via polled response or other types of protocols that rely on a central processor or similar device to manage DDCP to DDCP communications may be considered only if a similar device is provided as a stand-by. Upon a failure or malfunction of the primary device, the stand-by shall automatically, without any operator intervention, assume all BMCS network management activities.
- C. The failure of any DDCP on the network shall not affect the operation of other DDCP's. All DDCP failure shall be annunciated at the specified alarm printers and terminals.
- D. Network shall support a minimum communications speed of 115.2 Kbps.
- E. The network shall support a minimum of 100 DDC controllers and PC workstations.
- F. Each PC workstation shall support a minimum of 4 peer-to-peer networks, either by hardwired connection or dial up.

- G. The system shall support integration of third-party systems (fire alarm, security, lighting, PCL, chiller, boiler) via panel mounted open protocol processor. This processor shall exchange data between the two systems for inter-process control. All exchange points shall have full system functionality as specified herein for hardwired points. Provide examples of 5 reference projects utilizing gateways required for this project.

## 2.4 DDCP HARDWARE

- A. Each DDCP shall consist of a 32-bit microprocessor and controller, power supply, input / output boards and communication board. All program and point databases shall be stored in battery-backed RAM. Provide a minimum of 1.2 MEG RAM in each DDCP to allow for point expansion and trend data storage.
- B. Each DDCP shall incorporate a real-time clock.
- C. Each DDCP shall be provided with two RS232 communications port. Connecting an operator terminal, whether portable or stationery, shall allow the user to communicate with the entire network.
- D. Each DDCP shall provide for input / output connections to field equipment. The following point types shall be supported:
  - 1. Analog inputs - for measuring sensed variables. Inputs shall be capable of accepting voltage, resistance, current or pressure signals.
  - 2. Analog outputs - for controlling end devices. Outputs shall be capable of producing voltage, resistance, current or pressure signals. Pneumatic outputs shall be provided with a manual override for adjusting outputs in the event of a power loss at the DDCP.
  - 3. Digital inputs - for monitoring dry contacts such as relays, switches, pulses, etc.
  - 4. Digital outputs - to control two position devices such as starters, actuators, relays, etc.
- E. Each DDCP shall be listed under UL916 (Energy Management Systems) and shall be tested to comply with sub-part J of Part 15 FCC rules for Class A computing equipment.
- F. Each DDC Controller shall have sufficient memory to support its own operating system and databases, including:
  - 1. Control processes
  - 2. Energy management applications
  - 3. Alarm management applications including custom alarm messages for each level alarm for each point in the system.
  - 4. Historical/trend data for points specified
  - 5. Maintenance support applications
  - 6. Custom processes
  - 7. Operator I/O
  - 8. Dial-up communications
  - 9. Manual override monitoring
- G. Operator shall have the ability to manually override automatic or centrally executed commands at the DDC Controller via local, point discrete, on-board hand/off/auto operator override switches for digital control type points and gradual switches for analog control type points.
  - 1. Switches shall be mounted either within the DDC Controllers key-accessed enclosure, or externally mounted with each switch keyed to prevent unauthorized overrides.
  - 2. DDC Controllers shall monitor the status of all overrides and inform the operator that automatic control has been inhibited. DDC Controllers shall also collect override activity information for reports.
- H. DDC Controllers shall provide local LED status indication for each digital input and output for constant, up-to-date verification of all point conditions without the need for an operator I/O device. Graduated intensity LEDs or analog indication of value shall also be provided for each analog output. Status indication shall be visible without opening the panel door.
- I. In the event of the loss of normal power, there shall be an orderly shutdown of all DDC Controllers to prevent the loss of database or operating system software. Non-volatile memory shall be incorporated for all critical controller configuration data and battery backup shall be provided to support the real-time clock and all volatile memory for a minimum of 72 hours.

1. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.
2. Should DDC Controller memory be lost for any reason, the user shall have the capability of reloading the DDC Controller via the local RS-232C port, via telephone line dial-in or from a network workstation PC.
3. Upon restoration of normal power, the DDC Controller shall automatically resume full operation without manual intervention.

## 2.5 PROGRAMMING FUNCTIONS

- A. Resident software in each DDCP shall provide custom programming of control strategies.
  1. Point database
  2. Operator interface
  3. Network communications
  4. Facilities and energy management functions
- B. Programming of control and energy management strategies shall be accomplished via a high-level computer language such as BASIC, JC BASIC, C, or Powers Process Control Language. A standard math processor shall be part of the programming language. All analog loops shall be capable of proportional, integral, and derivative control.
- C. Each DDCP shall incorporate an operator interface program (OIP) that provides an English language user interface. The OIP shall allow the user to program, interrogate, command, and edit the BMCS via a self-prompting method. Operator terminals, whether textual or graphical, shall be able to access the entire network from any DDCP. Access shall be accomplished in a transparent fashion; that is, the operator shall not be required to address specific DDCP's in order to display or command system points.

## 2.6 FACILITY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with standard and custom report generation functions that include:
  1. Alarm summaries
  2. Motor status summaries
  3. Point displays by type, system, status, overrides, failures, location, equipment and enabled/disabled.
  4. Program listings
- B. All reports shall be either displayed or printed by:
  1. Operator request.
  2. Time of day.
  3. Event conditions (such as in response to an alarm, interlock, etc.).
- C. All reports shall be time and date stamped.
- D. An alarm-processing program shall be provided to annunciate those points designated as alarmable. Alarm points shall, upon alarm occurrence, be displayed or printed at designated terminals.
- E. Historical trend data shall be collected and stored at each DDCP for later retrieval. Retrieval shall be manual or automatic. Any point, physical or calculated, may be designated for trending. The system shall allow for two methods of trend collection: Either by a pre-defined time interval sample or upon a pre-defined change of value. Trend data shall be presented in a columnar format. Each sample shall be timed stamped. Trend reports may be a single point or may be a group of points, up to a maximum of (8) points in any single group. Any point, regardless of physical location in the system may become part of a multiple point group.
- F. Each BMCS network shall provide a point-monitoring function that can display single or multiple points in a continuous updated fashion for dynamic displays of point values.
- G. A database and configuration report program shall be provided that allows the user to interrogate BMCS status. As a minimum, the user shall be able to: Verify available RAM at each DDCP, verify DDCP status (on-line, off-line, and failed) and set the system clock.

- H. Any invalid operator entry shall result in an error message.
- I. DDCP's shall contain a password access routine that will assign an operator to one of three level of access. Level 1 shall permit display function only; level 2 shall additionally permit commanding of system points and level 3 shall additionally permit full program and database editing.
- J. DDCP's shall provide for the accumulation of totalized values for the purposes of run-time or energy totalization. Totalized values may be displayed or printed automatically or by operator request.

## 2.7 ENERGY MANAGEMENT SOFTWARE

- A. The BMCS shall be provided with an optimal start program such that the building may be divided into ten zones for optimum start. Warm-up and cool-down shall occur in sequence with succeeding zones starting only after the preceding zone has completed its warm-up or cool-down.
  - 1. The optimum start-up time of assigned equipment shall be determined based on a software calculation that takes into consideration outdoor air conditions, space conditions, and building thermal characteristics ("U" factor).
  - 2. The optimum start program shall control start-up of the cooling and heating equipment to achieve the target occupancy space temperature at the precise time of building occupancy.
  - 3. A built-in "learning" technique shall cause the BMCS to automatically adjust itself to the most effective time to start equipment based on historical data.
- B. The BMCS shall be provided with an operator interactive time of day (TOD) program. TOD programming and modifying shall be accomplished in a calendar-like format that prompts the user in English language to specify month, year, day and time and associated point commands. It shall be possible to assign single points or groups of points to any on or off time. Appropriate time delays shall be provided to "stagger" on times.
  - 1. TOD shall incorporate a holiday and special day schedule capability, which will automatically bring up a pre-defined holiday or special day schedule of operation. Holidays or special days can be scheduled up to one year in advance.
  - 2. In addition to the time dependent two-state control, TOD also provides time dependent setpoint control. This control provides the capability to output assignable, proportional setpoint values in accordance with the time of day and day of week. This program shall be used to accomplish night setback, morning warm-up and normal daily operating setpoints of all control system loops controlled by the BMCS. As with the two-state control, time dependent setpoint control shall be subject to the holiday schedule. The setpoints desired shall be user definable at any operator terminal.
  - 3. The operator shall be capable of reading and/or altering all sorted data pertaining to time of day, day of week, on/off times, setpoint values, and holiday designation.
  - 4. The TOD program shall also provide an override function that allows the user to conveniently change a start or stop time for any point up to one week in advance. The override command shall be temporary. Once executed the TOD program shall revert to its original schedule.
  - 5. The TOD program shall interface with the optimal start program (OSP) such that stop times may be assigned by OSP.
- C. Additional Program functions required are to be installed and programmed as requested by end user at no additional cost:
  - 1. Enthalpy optimization.
  - 2. Supply air reset.
  - 3. Hot water reset.
  - 4. Chilled water reset.
  - 5. Volumetric control.
  - 6. Dead band control. Install dual set points as requested by user.
  - 7. All specified energy management programs, whether or not applicable to this project, shall be provided such that the owner may enable the program at a future date without the need to purchase additional software or modify existing software.

## 2.8 WEB SERVER ACCESSIBILITY

- A. Industry leading encryption technology to provide accessibility through a web browser.

### BUILDING MANAGEMENT AND CONTROL SYSTEM

- B. Building Manager's ability to access, view and command critical building information in real time over the intranet or internet.
  - 1. Alarm Display
  - 2. Point Commanding
  - 3. Graphic Display
  - 4. Scheduling
  - 5. Running Reports
  - 6. Point Details

## 2.9 REMOTE NOTIFICATION

- A. Remote notification sends Alarm and System Event information to various notification devices as indicated below but not limited to. Operators can receive their building automation system alarms without restricting them to dedicated workstations.
  - 1. Alphanumeric pagers
  - 2. Numeric pagers
  - 3. Email
  - 4. Phones via voice or short message service (SMS)

## 2.10 POINT EXPANSION MODULES

- A. Capable of extending its input/output capabilities via special purpose modules.
  - 1. Modules may be mounted remote from the DDCP.
  - 2. Shall communicate with the DDCP over a pair of twisted cables.

## 2.11 TERMINAL EQUIPMENT CONTROLLERS

- A. Provide for control of each piece of equipment, including, but not limited to, the following:
  - 1. Variable Air Volume (VAV) boxes
  - 2. Constant Air Volume (CAV) boxes
  - 3. Dual Duct Terminal Boxes
  - 4. Unit Conditioners
  - 5. Heat Pumps
  - 6. Unit Ventilators
  - 7. Room Pressurization
  - 8. Fan Coil Units
- B. Include the following items:
  - 1. All input and outputs necessary to perform the specified control sequences.
    - a. Analog outputs shall be industry standard signals such as 24V floating control.
  - 2. Sufficient memory to accommodate point database, operating programs, local alarming, and local trending.
  - 3. All databases and programs shall be stored in non-volatile EEPROM, EPROM and PROM, or minimum of 100-hour battery backup shall be provided.
  - 4. Return to full normal operation without user intervention after a power outage of unlimited duration.
  - 5. Operation programs shall be field selectable for specific applications.
  - 6. Specific control strategy requirements, allowing for additional system flexibility.
  - 7. Controllers that require factory changes of all applications are not acceptable.

## 2.12 ELECTRONIC DAMPER ACTUATORS

- A. Two position damper operators:
  - 1. Non-spring return
  - 2. Built in auxiliary switches (motor end switches)
    - a. Switch shall be fully adjustable so that cut-in/cut-out points may be preset at any point within angular travel of the motor.
  - 3. Minimum torque 60-in-lb
  - 4. Constructed fully from epoxy coated galvanized steel, aluminum or 304 stainless steel.
- B. Modulating damper operators:
  - 1. Non-spring return

2. Sized with sufficient reserve power to provide smooth modulating action and tight close off against the system pressure.
3. Select the operator with available torque to exceed the maximum required operating torque by not less than 100%
4. Built in auxiliary position indication feedback to be connected to the BMCS.
5. Minimum torque 100 in-lb.
6. Constructed fully from epoxy coated galvanized steel, aluminum or 304 stainless steel.

#### 2.13 ETHERNET CARD

- A. Ethernet Card:
1. Local area network connection interface card.

#### 2.14 CONTROL CABINETS

- A. Fully enclosed NEMA 1 for indoors, NEMA 4 for outdoors.
1. Powder coat painted on all sides
  2. Cabinet with continuously piano type hinged door
  3. Locking latch
  4. All locks shall use a common key
  5. Devices on the panel face must be identified with engraved nameplates.
  6. Panels or termination panels must be identified with engraved nameplates.
  7. Provide enamel beige finish and extruded aluminum alloy frame UL 50 certified.

#### 2.15 AUTOMATIC CONTROL VALVES

- A. Pressure ratings: Minimum 125 psig or 1.25 times maximum system operating pressure.
- B. Construction:
1. 2" and smaller:
    - a. Screwed.
    - b. Bodies and internal parts: Bronze, stainless steel, or other approved corrosion-resistant metal.
  2. 2-1/2" and larger:
    - a. Flanged.
    - b. Bodies: Cast iron or cast steel.
    - c. Seats and parts exposed to fluid: Bronze, stainless steel, or other approved corrosion-resistant metal.
  3. Characterized port ball valves are acceptable for VAV terminal units only.
- C. Modulating straight through water valves: Equal percentage contoured throttling plugs.
- D. Three Way Mixing Valves: Linear throttling plugs allowing total flow through valve to remain constant regardless of position.
- E. Sizes: By Automatic Control System Manufacturer for fully modulating operation.
1. Minimum pressure drop: Equal to pressure drop of coil or exchanger.
  2. Maximum pressure drop: 5.5 psi.
  3. Relief and bypass valves: Sized according to pressure available.
  4. 2-position valves: Line size.
  5. Manual by-pass operator.
- F. Electronic Actuator:
1. Direct coupled installation
  2. Visual and electronic stroke indicator
  3. Die-cast aluminum housing
  4. Manual override
  5. Self-lubricating bearing and gear train
  6. Automatic calibration
  7. Automatic duty cycle protection
  8. Overload and stall protection
  9. Non-spring return

10. Floating /0-10 VAC / 4-20mA operation
11. UL approved
12. Provide smooth modulating action and tight close off against the system pressure.
13. Torque to exceed the maximum required operating torque by not less than 150%.
14. Actuator input signal shall be compatible with output DDC controller.
15. Provide weatherproof enclosure (exterior use).
16. Damper actuators not acceptable for valves.

## 2.16 TEMPERATURE LOW LIMIT SWITCH

- A. Responsive to the coldest 1' section of its length.
1. Double pole single throw switch
  2. 20' capillary
  3. Line voltage with bellows actuated switch
  4. Auto reset for outdoor installation
  5. Manual reset for indoor installation

## 2.17 TEMPERATURE AND HUMIDITY SENSORS

- A. Space Temperature Sensors
1. Thermister with resistance of 10,000 ohms at 77°F.
  2. Accuracy shall be +/-1/2°F.
  3. Range of 55° to 95° F.
  4. Flush mounted (edit for each project)
    - a. Stainless steel flush mount sensor, submit sample for review.
  5. Location and height to be approved by Architect/Engineer prior to installation.
- B. Space / Duct Humidity Sensor
1. Capacitance element in the space or duct as required and output a 4 to 20 MA signal proportional to 0 to 100% RH to the DDC.
  2. Capacitance element shall be field replaceable and not require calibration.
  3. Accuracy shall be +/-2% in the range from 20 to 95% RH.
  4. Relative humidity sensors shall have the sensing element of inorganic resistance media.
  5. Provide impact resistant Polycarbonate equal to BAPI-Guard covers suitable for institutional use. Submit sample for review.
  6. Provide manufacturers calibration certificate.
  7. Provide impact resistant Polycarbonate equal to BAPI-Guard guards in the following locations:
    - a. Corridors
    - b. Cafeteria
    - c. Kitchen.
    - d. Gymnasium.
    - e. Dressing Rooms.
    - f. Industrial Labs.
- C. Duct Temperature Sensors
1. Range of 20° to 120°F.
  2. Single point sensing of temperature.
  3. Averaging elements of sufficient length to sense temperature across 2/3 duct width.
  4. Averaging elements of sufficient length to provide accurate, representative indication and control.
  5. Averaging elements of sufficient length to prevent variances in temperature or stratification.
- D. Liquid Immersion Temperature Sensors
1. Platinum type resistance temperature detector (RTD).
  2. Match sensor range to medium being monitored.
    - a. Hot water range 30° to 250°F.
    - b. Chilled Water 20° to 70°F.
  3. Furnish stainless steel wells for installation by Mechanical Contractor.
  4. Locate all sensors in field with Owner/Engineer present.
  5. System accuracy for liquid temperature sensing shall be +/-1/2°.
  6. Sensors must be removable from wells.



- E. Outside Air / Freezer / Cooler Sensors
  - 1. Range of -58° to 122°F.
  - 2. Weatherproof sun shield.
  - 3. External trim material corrosion resistant with all parts assembled into watertight, vibration-proof, heat resistant assembly.
  - 4. Minimum of 8' long leads.
  - 5. Encapsulated into Type 304 stainless steel tubes with low conductivity moisture proofing material and lag extension for thickness of insulation.

## 2.18 CURRENT SENSITIVE RELAYS

- A. Ensure compatibility with VFD applications for variable speed motor status.
  - 1. Provide with adjustable set point.
  - 2. Relays must be mounted and not hung by power wires thru CT.
  - 3. Provide split-core type current sensors.
  - 4. Loop powered.
  - 5. LED Status.
  - 6. Acceptable Manufacturer: Veris Industries / Hawkeye
  - 7. Relays shall close status contacts in response to current flow in power leads to the equipment being monitored.

## 2.19 ELECTRIC REMOTE BULB THERMOSTAT

- A. Two position remote bulb thermostat:
  - 1. Bimetal controlled.
  - 2. Sealed mercury switches.
  - 3. Provide specified control action.
  - 4. Adjustment can be made by removing unit cover.
  - 5. Element with capillary length as required for the location.

## 2.20 ELECTRIC SPACE THERMOSTAT

- A. Two position space thermostat.
  - 1. Single Pole switch actuated by bi-metal sensing element.
  - 2. Range shall be 60°F to 90°F.
  - 3. Removable external knob adjustment means.

## 2.21 HIGH STATIC PRESSURE SWITCH

- A. With manual reset switch
  - 1. Approved manufacturer: Cleveland AFS-460.

## 2.22 INSERTION FLOW SENSORS

- A. Turbine Flow Meter
  - 1. Retractable hot tap flow sensor
  - 2. Accuracy: +/- 1% of full scale
  - 3. Dual Turbine
  - 4. Custom thread-o-let 400 psi / 250°F rated
  - 5. Line size from 2-1/2 to 72 inch
  - 6. Metering ranges from 0.3 to 15 f/sec.
  - 7. Remote NEMA 4 wall mounted LCD display
  - 8. Field Pro Software & Communicator
  - 9. Warranty two years
  - 10. Approved Manufacturer: Onicon Flow Meter F1200 Series
- B. Electromagnetic Flow Meter
  - 1. Retractable hot tap flow sensor
  - 2. Accuracy: +/- 1% of full scale
  - 3. Electromagnetic
  - 4. Custom thread-o-let 400 psi / 250-degree F rated.
  - 5. Line size from 1-1/4 to 72 inch

6. Metering ranges from 0.3 to 15 f/sec.
7. Remote NEMA 4 wall mounted LCD display
8. Field Pro Software & Communicator
9. Warranty two years
10. Approved Manufacturer Onicon Flow Meter F3500

## 2.23 CONTROL DAMPERS

- A. Opposed blade dampers.
1. Frames of 13-gauge galvanized sheet metal.
  2. Provisions for duct mounting.
  3. Damper blades not exceeding 8" in width.
  4. Blades of two sheets of 16-gauge galvanized sheet metal.
  5. Blades suitable for high velocity performance.
  6. Bearings of nylon or oil-impregnated, sintered bronze.
  7. Shafts of 1/2" zinc-plated steel
  8. Leakage does not exceed 1/2% based on 2000 fpm and 4" static pressure.
  9. Replaceable resilient seals along top, bottom and sides of frame and blade edge.
  10. Submit leakage and flow characteristics data with shop drawings.
  11. Linkage shall be concealed out of the air stream within damper frame.
  12. Acceptable Model is Ruskin Model CD60.

## 2.24 PHOTOCELL CONTROL

- A. Light Sensitive Resistor.
1. 4-20 output or switch.
  2. On = 3.0 / fc. Off 10.0 / fc.
  3. UL Approved.

## 2.25 DRAIN PAN FLOAT SWITCH

- A. Rated at 10 Amps.
1. Shuts off equipment if water level becomes too high.
  2. DPDT Contacts.

## 2.26 BY-PASS AUTOMATIC SHUT-OFF TIMERS

- A. Rated at 10 Amps, 125 VAC
1. Shuts off equipment with timed switch
  2. White decorated timer
  3. Without hold feature
  4. Time Cycle 60 minutes

## 2.27 CO<sub>2</sub> SENSOR

- A. Telaire Model T5100 CO<sub>2</sub>/Temperature Sensor or approved equal
1. Local visual indication of CO<sub>2</sub> levels in enclosed spaces.
  2. Pre-calibrated with factory default settings of 1000 ppm and 1500 ppm CO<sub>2</sub> levels
  3. Bright LED indicator transitions between green, yellow, and red as the CO<sub>2</sub> threshold is exceeded.
    - a. Accuracy: +/- 30 ppm @ 72°F
    - b. Output: 0-10 V (100Ω output impedance) and NTC 20k Thermister

## 2.28 AIR FLOW SENSING SWITCH

- A. The pressure sensing element shall be of the convoluted diaphragm type for sensitivity to system positive, negative, or differential pressure.
1. Select the pressure range based on the sensed differential pressure.
  2. The unit shall be protected against overpressure to the full static pressure rating.
  3. Accuracy: +/- 2% of full scale
- B. Switch assembly:
1. Reed switch

2. Field adjustable setpoint
3. Threaded boss conduit entrance
4. SPST Action
5. Voltage and rating as required for the control circuit

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. The control system shall be installed, and final adjustments made by full-time employees of the factory approved BMCS Building Management Control Subcontractor.
- B. The contractor shall collaborate through Architect / Engineer and Owner to determine the Owner's preference for naming conventions, etc. before entering the data into the system.
- C. Due to actual operational or space conditions, it may be necessary for the Contractor to make sequence of operation modifications and/or controller adjustments, change the location or type of sensor to obtain proper operation and coverage of the system in each room or space. These change, if requested by the Owner or Engineer, shall be performed at no additional cost to the Owner. Therefore, labor allowances should be made for such changes and adjustments if requested.
- D. Points listed within this section are to be connected to the BMCS system as hard-wired points to cards and not connected through BacNet integration. The BacNet interface is for read only points not included within sequences of this specification.

#### 3.2 INTERLOCK AND SAFETY CIRCUITS

- A. Close the outdoor air dampers when the related HVAC unit supply or exhaust fan is de-energized:
  1. The damper and actuators are specified in this section.
  2. Outdoor air damper shall be fully opened before related air handling unit fan is energized for 100% outside air use.
  3. Provide motorized outside air dampers for the following:
    - a. Supply fans
    - b. AHUs
    - c. Exhaust fans (except kitchen exhaust)
- B. Close the chilled and hot water valves to the coil when the related unit is de-energized.
- C. Exhaust/Supply Fans:
  1. Interlock the related exhaust and supply fans and the related outside air damper.
  2. Interlock the exhaust fans with the related air-handling unit through software.
  3. Interlock related exhaust fan for dishwasher with time delay off relay.
  4. Interlock related exhaust fan for kiln with time delay off relay
  5. Interlock kitchen hood related supply and exhaust fans.
  6. Provide additional interlocks as indicated on fan schedule and on drawings.
  7. Interlock electrical and mechanical room exhaust fans with thermostat.
  8. Interlock refrigerant monitor with mechanical room purge system.
  9. Interlock science room related supply and exhaust fans.
  10. Interlock outside air supply fans for VAV air-handling unit with air-handling unit status point.
- D. Freeze Protection:
  1. Provide a freeze protection sequence to ensure proper operation of equipment during a freeze condition not limited to the following:
    - a. Outside Air Handling Units & Supply Fans with heating and cooling coils: If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, open both heating and cooling valves to enable full flow condition. If

heating coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition, disable unit, close outside air damper, and open both heating and cooling valves to enable full flow condition. Ensure HW & CHW pumps are operational.

- b. Boilers - Enable during a freeze condition.
  - c. Chillers – Open isolation valves then command by-pass valve to dump water into basin or by-pass tower. Enable condenser water pumps during a freeze condition.
  - d. Air Cooled Chillers – Open isolation valves, then enable pumps, run cycle for 15 minutes per hour, open all chilled water valves.
  - e. Protect coils downstream of DX cooling coil with freeze protection. If unit is in occupied or unoccupied mode, upon the triggering of software point indicating a freeze condition or the low temperature sensor (freeze stat) indicates a freeze condition, the system will be disabled, close the outside air damper, disable the DX cooling coil. If coil discharge air sensor indicates a failure to control and is below setpoint then enable software point indicating a freeze condition.
2. Temperature low limit switch wired with double pole single throw switch with one switch leg hard-wired to de-energize fan and one switch leg to signal BMCS.
- E. Drain Pan Float Protection:
- 1. Interlock to shut down unit and close valves.
  - 2. Cooling Coils mounted above ceiling and in roof mounted units.
  - 3. Provide for each cooling coil location.
  - 4. Signal BMCS alarm point

### 3.3 GRAPHICS

- A. Furnish as-built drawings indicating finally corrected "as installed" diagram(s) of the complete Building Management Control System.
  - 1. Modification of existing control systems shall be included.
  - 2. These must be as built and any changes during the warranty period drawings must be revised and updated.
  - 3. Provide final sequence of operation in written format.
- B. Provide a set of the "as installed" diagram(s) of the complete control system laminated in plastic and hung in the main mechanical room or as directed by Owner.
- C. Provide a color-coded floor plan of the building showing the location of each system, and the area served by each AHU or related zone. These must be of professional quality. Floor plan is to hang in main mechanical room near central control panel.
- D. Provide computer graphics for each system.
- E. Provide final graphic room numbers as selected by Owner / Architect. Obtain a graphic submittal package for review. Construction Drawing room numbers are not to be used unless approved in writing.

### 3.4 IDENTIFICATION

- A. Provide a laminated engraved nameplate on all control panels and devices shown on the "as installed" control diagrams. Coordinate engraving with nomenclature used on the diagrams.
- B. A black-white-black laminated plastic engraved identifying nameplate shall be secured to each terminal cabinet, and control panels. Identifying nameplates shall have ½ inch high, engraved letters.

### 3.5 WIRING FOR BUILDING MANAGEMENT AND CONTROL SYSTEMS

- A. Furnish and install all wire, conduit, raceways, and cable systems required for the complete operation of the Building Management and Control System.
- B. All wiring for the Building Management and Control System is specified in this section and includes, but is not limited to:

#### BUILDING MANAGEMENT AND CONTROL SYSTEM

1. Wiring of interlock system.
  2. Wiring of control instruments.
  3. Wiring of control panels.
  4. Wiring of related power supplies, i.e., transformers.
  5. Wiring of 120 VAC power circuits for control panels and devices.
- C. All materials and methods specified in this section shall comply with the requirements specified in Division 26 of this specification.
- D. All power supply requirements shall be connected to the building electrical distribution system in an approved manner. Do not connect control equipment of circuits common with other building loads or devices.
- E. Temperature control wiring shall be jacketed cables installed with or without conduit as specified below or single conductors installed in conduit. Control wiring shall have minimum 300V insulation for low voltage wiring and 600V insulation for line voltage wiring.
- F. All line voltage control wiring, all low voltage control wiring which is exposed in the central plant, penthouse, and other similar spaces; all low voltage control wiring which is routed through concealed inaccessible locations shall be installed in conduit.
- G. All low voltage control wiring which is routed through concealed accessible locations may be run without conduit provided that the wiring run without conduit is properly supported from the building structure on maximum 5' centers and does not depend upon the ceiling grid or the ceiling support system for support. Wiring run in plenum spaces shall be plenum rated. Support all plenum wiring in accessible locations in bridle rings, J-hooks, D rings. Plenum wiring is not to be supported within building structure or attached to conduit raceways. All low voltage wiring must be installed through supports. Wires shall be supported on 5' centers and identified at each termination point and at 50' centers minimum. Install wire parallel or perpendicular to the structural features of the building.
- H. Line and low voltage control wiring shall not be installed in the same conduit with control wiring and shall not be installed in the same conduit with power wiring.
- I. All wiring associated with building management and control system cover shall be as follows:
1. Sensor jacket color, Green
  2. LAN communications, Yellow
  3. All THHN wiring shall comply with Division 26 insulation color identification

### 3.6 EXHAUST AND SUPPLY FANS

- A. Provide interlocks as scheduled on the plans unless shown on the electrical drawings.
- B. Provide BMCS override to disable operation of all exhaust and supply fans interlocked and/or specified throughout project.
- C. Where indicated on drawings BMCS shall provide a local low voltage switch to enable fan operation for a period of 60 minutes (adjustable).

POINT DESCRIPTION	TYPE	DEVICE
Start/stop	DO	Control Relay
Exhaust Air Damper	DO	Electronic Operator
Fan Status	DI	Current Sensitive Relay
Momentary Control Switch	DI	Push Button Switch (Where indicated)
Damper Status	DI	Damper End Switch

### 3.7 SINGLE ZONE AIR HANDLING UNITS WITH HUMIDITY CONTROL

#### BUILDING MANAGEMENT AND CONTROL SYSTEM

- A. These units are furnished with a chilled water-cooling coil and a hot water coil in the reheat coil position. Controls shall be as follows:
1. A space temperature sensor (in each room) shall average space temperatures, acting through the DDC panel, modulate the valves on the chilled water-cooling coil and hot water reheat coil, in sequence, to maintain the desired space temperatures.
  2. A humidity sensor, located in each room shall average room humidity, acting through the DDC panel, modulate the valve in the chilled water coil to maintain 55-degree discharge air when space is above its humidity setpoint and in dehumidification.
    - a. The space temperature sensor shall modulate the valve on the hot water reheat coil to maintain space temperature.
  3. The Space Humidity Sensor shall monitor the space relative humidity at all times. If the space relative humidity rises above the setpoint when the system is de-energized, override the BMCS.
    - a. Energize Air Handling Unit and Central Plant Equipment.
    - b. Outside air damper shall remain closed and related exhaust fans de-energized.
  4. An outside air unit provides the outside air for single-zone air handling unit; the outside air unit shall be activated during the occupied periods.
  5. A float switch located in the overflow drain pan shall disable unit and send alarm through BMCS.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Variable Speed Motor	AO	Motor Controller
Space Temperature	AI	Space Thermistor (Each Room)
Space Humidity	AI	Humidity Sensor (Each Room)
CHW Valve	AO	Electronic Operator
Chilled Water Coil Discharge Temp.	AI	Duct Thermistor
HW Valve	AO	Electronic Operator
Hot Water Coil Discharge Temp.	AI	Duct Thermistor
Overflow Drain Pan	DI	Drain Pan Float Switch

### 3.8 OUTSIDE AIR HANDLING UNIT CONTROL

- A. These units are furnished with a chilled water coil and a hot water heating coil in the PREHEAT position. Control shall be as follows:
1. A unit mounted chilled water coil leaving air temperature sensor shall, acting through the Direct Digital Control Panel, modulate the valve on the cooling coil and the valve on the hot water coil, in sequence, to maintain the desired discharge air temperature as scheduled on drawings (adjustable). The air-handling unit shall be started and stopped from the BMCS System.
  2. When chilled water temperature is equal to or less than 48 degrees, open OA damper and start unit fan. Unit shall not be enabled until damper is open. Provide damper status to ensure damper is in open in either the manual (hand) or auto position of the motor starter.
  3. A wall mounted space CO2 sensor shall monitor and average the space CO2 levels in each space associated with the OAHU and act through the Direct Digital Control Panel to modulate the fan speed to maintain the desired CO2 levels below 900 PPM (Adjustable). Outside air fan speed shall not be reduced below a value determined by TAB to ensure space is maintained at a positive pressure in relation to the outdoors.
  4. Provide a temperature low limit switch located on the discharge side of the hot water

preheat coil or the entering side of the cooling coil to de-energize the air handling unit, close the outside air damper, open the hot water valve 100%, start the boiler and hot water pump, signal an alarm to the BMCS when the temperature drops below 32°F. Device shall be manual reset.

5. A float switch located in the overflow drain pan shall disable unit and send alarm through BMCS.

POINT DESCRIPTION	TYPES	DEVICE
Start/Stop	DO	Control Relay
AHU Status	DI	Current Sensitive Relay
Variable Speed Motor	AO	Motor Controller
Chilled Water Coil Discharge Air Temp.	AI	Duct Thermistor
Entering Chilled Water Temp.	AI	Pipe RTD
CHW Valve	AO	Electronic Operator
Outside Air Damper	DO	Electronic Operator
Outside Air Damper Status	DI	Damper Position Indicator
Freeze Status	DI	Temperature Low Limit Switch
Hot Water Coil Discharge Air Temp.	AI	Duct Thermistor
HW Pre Heat Valve	AO	Electronic Operator
Space CO2 Concentration	AI	CO2 Sensor (Each room)
Overflow Drain Pan	DI	Drain Pan Float Switch

### 3.9 START-UP AND POINT VERIFICATION

- A. Final startup and point verification shall include the following information.
1. Field panel checkout:
    - a. Verify enclosure is not mounted on vibrating surface.
    - b. Verify class I and class II wiring are separated within enclosure.
    - c. Check for shorts/grounds/induced voltages/proper voltages.
    - d. Verify proper point terminations in accordance with as-builts.
    - e. Verify that all modules are in proper place and addressed.
    - f. Verify proper power voltage.
    - g. Load database and programming.
    - h. Startup the panel.
    - i. Point and device checkout.
  2. Analog input point checkout:
    - a. Verify the correct wiring terminations per the design documentation package, at the field panel. Verify that all wiring and terminations are neat and dressed.
    - b. Verify the point address by checking that the analog input instrument is wired to the correct piece of field equipment. Do this by altering the environment at the sensing element or by disconnecting one of the wires at the sensor and verifying that the reading at the field panel has reacted to this change.
    - c. Verify the point database to be correct, (i.e., alarmability, alarm limits, slope/intercept, engineering units, etc.). Verify that the correct change of value (COV) limit has been defined.
    - d. Verify the sensor has the correct range and input signal. (i.e., 20-120°F, 4 - 20 ma). Verify that the device is mounted in the correct location and is wired and

- installed correctly per the design documentation package.
    - e. Set-up and/or calibrate any associated equipment (i.e., panel LCD meters, loop isolators, etc.). Verify that these auxiliary devices are mounted in the correct location and are wired and installed correctly per the design documentation package.
    - f. Verify the correct reading at the field panel using appropriate MMI devices. Verify that any associated LCD panel meters indicate the correct measured value.
  - 3. Digital input point checkout:
    - a. Verify the device is correctly wired and terminated as shown in the design documentation package. Verify that all wiring and terminations are neat and properly secured.
    - b. Verify the point address by verifying that the digital input is correctly terminated at the controlled piece of equipment.
    - c. Verify the point database is correct (i.e., point name, address, alarmability, etc.).
    - d. Set-up and/or calibrate the associated equipment, i.e., smoke detector, high/low temp detector, high/low static switch, end switch, current relay, pressure switch, etc. is mounted in the correct location, and is wired and installed correctly per the control system installation drawings.
    - e. With the controlled equipment running or energized as described in the digital output checkout procedures, verify the correct operation of the digital input point and associated equipment by putting the digital input monitored equipment into its two states. Verify that the proof or status point indicates the correct value at the operator's terminal and that the status led is giving the proper indication in each mode of operation (on/off).
  - 4. Digital output point checkout:
    - a. Verify that device is correctly wired and terminated as shown in the design documentation package.
    - b. Verify that the correct voltage is utilized in the circuit.
    - c. Verify the point database to be correct (i.e., point name, address, etc.).
    - d. Check and verify that the end device responds appropriately to the digital output(s).
    - e. After verifying the set-up and operation of any associated digital input/proof points, check and verify correct operation of the logical point and associated equipment by commanding the point to all possible states (i.e., off, on, fast, slow, auto, etc.). Verify that the defined proof delay is adequate for all modes of operation.
    - f. If any interlocked equipment exists that has independent hand-off-auto or auxiliary control wiring, verify correct operation of same. Also check that any interlocked equipment such as EP switches for damper operation or exhaust and return fans are wired correctly and operate correctly.
    - g. Verify that the controlled piece or pieces of equipment cannot be caused to change state via the digital output if an associated hand-off-auto switch is in the hand/on or hand/off mode of operation, unless specified as a fireman's override point etc.
  - 5. Analog output point checkout:
    - a. Verify the correct wiring or piping terminations per the design documentation package, at the field panel. Verify that all wiring and piping terminations are neat and dressed.
    - b. Ensure that the correct output device(s) are installed per the Control System Installation Drawings. (i.e., I/P or P/I transducers, transformers, power supply, etc.). Verify that these devices are installed, wired, and piped correctly. Verify that any configuration jumpers are in the proper settings for the required application. Verify related transformers are fused in accordance with installation drawings.
    - c. Verify the point database to be correct. Verify that the correct COV limit has been defined.
    - d. Verify the point address by checking that the analog output is wired and/or piped to the correct output transducer and/or equipment.
    - e. Verify that the controlled device is calibrated (i.e., 3-8PSI valve, 8-13 PSI damper motor, 4-20 ma variable frequency drive, etc.) and is in the correct location, and is wired or piped and installed correctly per the design documentation package. If the controlled device is not calibrated, then a three-point (high, low, and mid-point) calibration procedure must take place. Verify



- proper operation of the end device. When calibration has been verified, ensure that installation drawings, point database, and PPCL have been updated.
- f. Set-up and or calibrate any associated equipment, (i.e., panel LCD meters, loop isolators, pneumatic gauges, etc.). Also verify that these auxiliary devices are mounted in the correct location and are wired or piped and installed correctly per the design documentation package.
  - g. After verifying the set-up and operation of any associated equipment check for the correct operation of the logical point and associated equipment by commanding the analog output to the top and bottom of its range. Verify that the control device(s) responded appropriately as indicated by the design documentation package. Check to ensure that all network terminals, host console devices, etc. can also command these outputs.
  - h. Check that all pneumatic gauges, pilot positioners and LCD panel meters indicate the correct values.
6. Terminal equipment controller checkout:
- a. Load program database
  - b. Enable programs
  - c. Verify sequence of operations
7. Programming checkout:
- a. Provide checkout for each system and sequence of operation.
  - b. The following are sample sequence of operations tests. The intent of these procedures is to provide a plan of action to verify system operations via block checks of the project specific sequence of operations. The procedures may be used in this format, or one procedure to a page should more detail be required. The procedures outlined below should be verified for accuracy and may be modified to meet your specific requirements.
  - c. Description of Test: AHU Alarm Checkout. Verify AHU-1 discharge air temperature alarming is operational and is received at the designated terminal.
  - d. Input to Trigger Test: Change discharge temperature high alarm limit through software to a value below the current discharge temperature (discharge temperature - 10°F).
  - e. Expected Outcome: A high temperature alarm will be received per the Alarm Definition Report at its designated terminal.
  - f. Provide signoff sheet with indication for test Pass, Fail, Date of test and Initials for signoff.
8. Workstation checkout:
- a. Verify the operation of all trunk interface equipment.
  - b. Verify all workstation software, including options, based upon the installation instructions for the PC.
  - c. Perform software backup (site, options, etc.)
  - d. Complete workstation configuration report for owner signoff.
  - e. Provide verification that all graphics have been created, as required by project bid documents.

### 3.10 TESTING AND ACCEPTANCE

- A. General:
- 1. After completion of installation and start-up procedures, commence the specified 3-phase verification and testing sequence leading to final acceptance.
    - a. Follow in the order specified.
    - b. Each testing phase shall be satisfactorily completed before entering the next phase.
  - 2. Prior to entering each phase of the sequence, submit for approval, a written agenda describing in detail the procedure to be followed to meet the requirements for each specified verification, test, or demonstration.
  - 3. Submit for approval, a sample of the form on which the test will be reported.
    - a. Identify project.
    - b. Provide a list of all points, arrange in numerical order of point addresses.
      - 1) Show point descriptor and location of each.
      - 2) Indicate DDC panel that processes each point.
      - 3) Use the list as a basis for the specified report form.
    - c. Signatures of participants and observers.
    - d. Results.

- e. Description of adjustment or corrections of points in error.
    - f. Date.
  - 4. Provide schedule of tests. Estimate dates of significant events.
  - 5. Test, calibrate and adjust each point in the system as specified.
  - 6. Provide documentation of all tests and verifications as specified.
  - 7. Provide trend reports indicating proper control of all points for an extended period of time.
- B. Phase 1 - Testing, Calibrating, and Adjusting:
- 1. Operate each analog point in the entire system.
    - a. At a point in the upper quarter of its range.
    - b. At a point in the lower quarter of its range.
    - c. At its operating point.
  - 2. Provide personnel and diagnostic instruments at both the central and remote locations.
  - 3. Provide testing stimulants for alarms.
  - 4. Use digital meters of double the accuracy of the instruments being calibrated.
  - 5. Provide an approved test device for simulating high and low temperatures.
  - 6. When the function is performed, read values at the central control, and observe the actual function at the field instrument.
  - 7. Exercise each binary point and observe indication at console and simultaneously observe operation in the field.
  - 8. Submit an operation report for each point in the system, in approved format, and describe any corrective or adjusting action taken.
  - 9. Test all power transducers with a Dranetz Power Analyzer.
- C. Phase 2 - Equipment and Point Verification:
- 1. Verify calibration or function of each point.
    - a. Verify analog points at operating value.
    - b. Record on specified form.
    - c. Make approved adjustments to out of tolerance points.
      - 1) Identify these points for ready reference.
  - 2. After verification procedure is completed:
    - a. Verify corrected points.
    - b. Record on specified form.
    - c. Points requiring correction.
      - 1) Replace sensor or actuator if electrical measurements indicated components are out of specified tolerance.
- D. Phase 3 - Software Verification:
- 1. Submit agenda and report format for software demonstrations.
  - 2. Demonstrate to the Owner and the Engineer that all software programs and automatic control sequences function as specified.
  - 3. Demonstrate compliance with response time specifications.
    - a. Simulate normal heavy load conditions.
    - b. Initiate at least ten successive occurrences on normal heavy load conditions as specified, and measure response time of typical alarms and status changes.
  - 04. Provide written documentation of demonstration, signed by representatives of the Contractor and Engineer.
- E. Provide the following reports to Engineer at final completion of all Testing:
- 1. List of all points.
  - 2. List of all points currently in alarm.
  - 3. List of all disabled points.
  - 4. List of all points in over-ride status.
  - 5. List of all points currently locked out.
  - 6. List of user accounts and access levels.
  - 7. List all weekly schedules.
  - 8. List of holiday programming schedules.
  - 9. List of limits and deadbands.
  - 10. System diagnostics reports including, list of DDC panels online and communicating, status of all DDC terminal unit's device points.
  - 11. List of programs.
  - 12. Provide trend data reports to ensure proper operation and sequence control of BMCS.

- F. Substantial Completion of the BMCS will not occur until completion and acceptance of all testing and acceptance procedures.

3.11 TRAINING

- A. The contractor shall provide factory-trained instructor to give full instruction to designated personnel in the operation of the system installed. Instructors shall be thoroughly familiar with all aspects of the subject matter they are to teach. The contractor shall provide all students with a student binder containing product specific training modules for the system installed. All training shall be held during normal working hours of 8:00 am to 4:30 PM weekdays.
- B. Provide 40 hours of training for Owner's designated operating personnel. Training shall include:
- Explanation of drawings, operations, and maintenance manuals
  - Walk-through of the job to locate control components
  - Operator workstation and peripherals
  - DDC controller and ASC operation/function
  - Operator control functions including graphic generation and field panel programming
  - Operation of portable operator's terminal
  - Explanation of adjustment, calibration, and replacement procedures
  - Student binder with training modules
- C. Since the Owner may require personnel to have more comprehensive understanding of the hardware and software, additional training must be available from the Contractor.

3.12 PROJECT MANAGEMENT

- A. Provide a designated project manager who will be responsible for the following:
1. Construct and maintain project schedule.
  2. Authorized to accept and execute orders or instructions from General Contractor, Owner / Architect & Engineer.
  3. Attend project meetings as necessary to avoid conflict and delays.
  4. Make necessary field decisions relating to this section.
  5. Coordination / Single point contact.
  6. Have Internet access for project management.

END OF SECTION

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SECTION 23 20 00

HVAC PIPE AND PIPE FITTINGS - GENERAL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install pipe and pipe fittings for piping systems specified in Division 23 - Mechanical.

1.2 RELATED WORK

- A. Division 23 Mechanical:
1. Earthwork.
  2. Valves, Strainers and Vents.
  3. Vibration Isolation.
  4. Insulation.
  5. Other Piping Sections

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. The particular type of pipe and fittings for each system is specified in the individual sections.

2.2 JOINTS

- A. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
- B. Dissimilar Metals. Make joints between copper and steel pipe and equipment using insulating unions or couplings such as Crane Company #1259; EPCO as manufactured by EPCO Sales, Inc.; or an approved equal.
- C. Solder joints.
1. Prior to making joints, cut pipe square and ream to full inside diameter. Clean exterior of pipe and socket. Apply a thin coat of suitable fluxing compound to both pipe and socket, and fit parts together immediately.
  2. Heat assembled joint only as required to cause the solder to flow. Run the joint full, slightly beaded on the outside, and wipe to remove excess solder.
  3. Use silver brazing alloy or Sil-Fos on refrigerant piping and on underground piping. Use lead free solder on all other copper piping.
- D. Make welded joints as recommended by the standards of the American Welding Society. Ensure complete penetration of deposited metal with base metal. Provide filler metal suitable for use with base metal. Keep inside of fittings free from globules of weld metal. The use of mitered joints is not approved.
- E. Flanged.
1. Prior to installation of bolts, center and align flanged joints to prevent mechanical pre-stressing of flanges, pipe or equipment. Align bolt holes to straddle the vertical, horizontal or north-south centerline. Do not exceed 3/64" per foot inclination of the flange face from true alignment.
  2. Use flat-face companion flanges only with flat-faced fittings, valves or equipment. Otherwise, use raised-face flanges.
  3. Install gaskets suitable for the intended service and factory cut to proper dimensions. Secure with manufacturers recommended gasket cement.
  4. Use ANSI nuts and bolts, galvanized or black to match flange material. Use ANSI 316 stainless steel nuts and bolts underground. Tighten bolts progressively to prevent unbalanced stress. Draw bolts tight to ensure proper seating of gaskets.
  5. Use carbon steel flanges conforming to ANSI B16.5 with pipe materials conforming to ASTM A 105 Grade II or ASTM A 108, Grade II, ASTM A 53, Grade B. Use slip-on type

HVAC PIPE AND PIPE FITTINGS – GENERAL

flanges on pipe only. Use welding neck type flanges on all fittings. Weld slip-on flanges inside and outside.

6. Keep flange covers on equipment while fabricating piping. Remove when ready to install in system.

- F. Mechanical Joints: Provide a stuffing box type mechanical joint adapted to use gasket, cast iron gland and bolts. Coat bolts with bitumastic enamel. Use joint parts similar in design to one of the following:
  1. Doublex Simplex Joint manufactured by the American Cast Iron Pipe Company, Birmingham, Alabama.
  2. U.S. joints manufactured by the United States Pipe and Foundry Company, Burlington, New Jersey.
  3. Boltite Joint manufactured by the McWane Cast Iron Pipe Company, Birmingham, Alabama.
  4. Flexlamp manufactured by the National Cast Iron Pipe Company, Birmingham, Alabama.

## 2.3 UNIONS

- A. Use 150 lb. standard (300 lb. WOG) malleable iron, ground joint unions with bronze seat. Provide flanged joints on piping 2-1/2" and larger.
  1. Where pipe material of different types join, use a dielectric union. Union shall be threaded, solder or as required for its intended use.

## 2.4 BRANCH CONNECTIONS

- A. Pipe 2" and Smaller: For threaded piping, use straight size reducing tee. When branch is smaller than header, a nipple and reducing coupling or swagged nipple may be used.
- B. 2-1/2" through 36": For welding piping, when branch size is the same as header size, use welding tee. For threaded branch connections, use 3000 lb. full coupling or Thread-o-let welded to header.

## 2.5 GASKETS

- A. High Temperature Piping: Provide 1/16" thick ring gaskets of aramid reinforced SBR such as Garlock #3200 or 3400 or equal by Advanced Products and Systems.
- B. Other Piping: Provide ring rubber gaskets, Garlock #7992 or equal by Advanced Products and Systems. Use 1/8" thick cloth reinforced neoprene gaskets. For smaller than 6", use 1/16" thick gasket.

## 2.6 FLOORS AND CEILING PLATES

- A. Provide chrome-plated floor and ceiling plates around pipes exposed to view when passing through walls, floors, partitions, or ceilings in finished areas; size plates to fit pipe or insulation and lock in place.

## 2.7 DOMESTIC MANUFACTURE

- A. All piping material, pipe and pipe fittings shall be manufactured in the United States of America.

# PART 3 - EXECUTION

## 3.1 PIPE FABRICATION AND INSTALLATION

- A. Make piping layout and installation in the most advantageous manner possible with respect to headroom, valve access, opening and equipment clearance, and clearance for other work. Give particular attention to piping in the vicinity of equipment. Preserve the required minimum access clearances to various equipment parts, as recommended by the equipment manufacturer, for maintenance.
- B. Cut all pipes to measurement determined at the site. After cutting pipe, remove burrs by reaming. Bevel plain ends of ferrous pipe.

- C. Install piping neatly, free from unnecessary traps and pockets. Work into place without springing or forcing. Use fittings to make changes in direction. Field bending and mitering is prohibited. Make connections to equipment using flanged joints, unions or couplings. Make reducing connections with reducing fittings only.
- D. Install piping without tapping out of the bottom of pipe.

### 3.2 WELD

- A. Weld and fabricate piping in accordance with ANSI Standard B31.1, latest edition, Code for Pressure Piping.
- B. Align piping and equipment so that no part is offset more than 1/16". Set fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the pipe so as to restrict flows. Tack welds, if used, must be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack welds during welding operation.
- D. Do not split, bend, flatten or otherwise damage piping before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside piping before tying into existing piping sections, fittings, valves or equipment.
- F. Bevel ends of ferrous pipe.

### 3.3 OFFSETS AND FITTINGS

- A. Due to the small scale of drawings, the indication of offsets and fittings is not possible. Investigate the structural and finish conditions affecting the work and take steps required to meet these conditions.
- B. Install pipe close to walls, ceilings and columns so pipe will occupy minimum space. Provide proper spacing for insulation coverings, removal of pipe, special clearances, and offsets and fittings.

### 3.4 SECURING AND SUPPORTING

- A. Support piping to maintain line and grade, with provision for expansion and contraction. Use approved clevis-type or trapeze-type hangers connected to structural members of the building. Single pipe runs to be supported by approved clevis type hangers. Multiple pipe runs to be supported by approved trapeze type hangers. Do not support piping from other piping or structural joist bridging. Review structural drawings for additional information.
- B. Provide supports both sides and within 12" of each horizontal elbow for pipe 6" and larger.
- C. Support vertical risers with steel strap pipe clamps of approved design and size, supported at each floor. Support piping assemblies in chases so they are rigid and self-supported before the chase is closed. Provide structural support for piping penetrating chase walls to fixtures. On chilled water pipe supports shall be outside the insulation.
- D. Where insulation occurs, design hangers to protect insulation from damage. Pipe saddles and insulation shields, where required, are specified in the appropriate insulation section and are sized in accordance with the schedule on the drawings.
- E. Install trapeze hangers, properly sized, to support the intended load without distortion. Use hangers with 1-1/2" minimum vertical adjustment.
- F. Use electro-galvanized or zinc plated beam clamps if acceptable to the structural engineer, threaded rods, nuts, washers and hangers. All hanger rods shall be trimmed neatly so that no more than 1 inch of excess hanger rod protrudes beyond the hanger nut. Use only on beams as directed by the Structural Engineer.

- G. At outdoor locations, all supports, brackets and structural members shall be hot-dipped galvanized.
- H. Provide hangers within 3' of pipe length from all coil connections.
- I. Support spacing: As recommended by the project structural engineer and support manufacturer, but not more than listed below. Not to exceed spacing requirements of smallest pipe.

Pipe Size	Copper & Steel Max. Support Spacing, Ft.	Cast Iron Max. Support Spacing, Ft.	Minimum Rod Diameter, Inches
1" & smaller	6		3/8
1-1/4" & 1-1/2"	8	5	3/8
2"	10	5	3/8
3"	10	5	1/2
4" & 5"	10	5	5/8
6" and above	10	5	3/4

### 3.5 PIPE SUPPORTS

- A. Provide P1001 or P 5000 Unistrut metal framing members and appurtenances for pipe support. Hot-dip galvanized members and appurtenances when located outside. Sagging of pipes or supports is not acceptable.
- B. Adjustable clevis hangers shall be used for single pipe supports; Anvil Fig. 260. When oversized clevis is used, a nipple shall be placed over the clevis bolt as a spacer to assure that the lower U-strap will not move in on the bolt. Provide adjustable clevis with a nut / washer above and below the hanger on the support rod. Ring type clevis hangers are not acceptable.
- C. Provide Anvil Figure 45 galvanized or primed and painted channel assembly for trapeze hangers.

### 3.6 PIPE SUPPORTS ON ROOF

- A. Support condensate drain pipe on roof with Portable Pipe Hanger Model PP-10 with roller and fully adjustable height throughout pipe run. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-oxidants. Provide with hot dip galvanized rod finish and framing. Nuts and washers shall be hot dip galvanized.

### 3.7 ANCHORS

- A. Provide anchors as required. Use pipe anchors consisting of heavy steel collars with lugs and bolts for clamping to pipe and attaching anchor braces. Install anchor braces in the most effective manner to secure desired results. Do not install supports, anchors or similar devices where they will damage construction during installation or because of the weight or the expansion of the pipe. When possible, install sleeves in structural concrete prior to pouring of concrete.

### 3.8 FLOOR PENETRATIONS

- A. At locations where pipe passes through floors, provide watertight concrete curb around penetration.

### 3.9 PIPE SLEEVES

- A. Sleeves through masonry and concrete construction:
  1. Fabricate sleeves of Schedule 40 galvanized steel pipe.
  2. Size sleeve large enough to allow for movement due to expansion and to provide continuous insulation.
- B. Sleeves through gypsum wall construction.
  1. Fabricate sleeves of 16 gauge galvanized sheet metal.
- C. Sleeves through elevated slab construction.



1. Fabricate sleeves of Schedule 40 galvanized steel pipe with welded center flange in floor.
  - D. Extend each sleeve through the floor or wall. Cut the sleeve flush with each wall surface. Sleeves through floors shall extend 2" above floor lines for waterproofing purposes. Slab on grade floors shall not be sleeved except where penetrating waterproofing membrane or insect control is required.
  - E. Caulk sleeves water and air tight. Seal annular space between pipes and sleeves with mastic compound to make the space water and air tight.
  - F. For sleeves below grades in outside walls, provide Thunderline Link-Seal or Advance Product and System Interlynx, with 316 stainless steel nuts and bolts, with cast iron pressure plate.
  - G. Provide chrome plated escutcheon plates on pipes passing through walls, floors or ceilings exposed to view. At exterior walls, stainless steel sheet metal is to be used.
  - H. For sleeves through fire and smoke rated walls, seal with a UL through-penetration firestop, rated to maintain the integrity of the time rated construction. Install in accordance with the manufacturer's installation instructions. Comply with UL and NFPA standards for the installation of firestops. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- 3.10 ISOLATION VALVES
- A. Provide piping systems with line size shutoff valves located at the risers, at main branch connections to mains for equipment, to isolate central plant, and at other locations.
- 3.11 DRAIN VALVES
- A. Install drain valves at low points of water piping systems so that these systems can be entirely drained. Install a line size drain valve for pipes smaller than 2" unless indicated otherwise. For pipes 2-1/2" and larger, provide 2" drain valves unless indicated otherwise. Drain valves shall be plugged when not in use and at completion.
- 3.12 CLEANING OF PIPING SYSTEMS
- A. General cleaning of piping systems. Purge pipe of construction debris and contamination before placing the systems in service. Provide and install temporary connections as required to clean, purge and circulate. Flush the chilled and hot water systems utilizing the filter feeders.
  - B. Install temporary strainers at the inlet of pumps and other equipment as necessary where permanent strainers are not indicated. Keep strainers in service until the equipment has been tested, then remove either entire strainer or straining element only. Fit strainers with a line size blow down ball valve and pipe to nearest drain. Blow down strainers, remove and clean as frequently as necessary.
  - C. Phase One: Initial flushing of system. Remove loose dirt, mill scale, weld beads, rust and other deleterious substances without damage to system components. Open valves, drains, vents and strainers at all system levels during flushing procedures. Flush until "potable water clear" and particles larger than 5 microns are removed.
  - D. Connect dead-end supply and return headers, even if not shown on the drawings, and provide terminal drains in bottom of pipe end caps or blind flanges.
  - E. Dispose of water in approved manner.
  - F. Phase Two: Cleaning of Piping Systems. Remove, without chemical or mechanical damage to any system component, adherent dirt (organic soil), oil, grease, (hydrocarbons), welding and soldering flux, mill varnish, piping compounds, rust (iron oxide) and other deleterious substances not removed by initial flushing. Chemical shall be equal to Nalco 2578 prepping compound. Insert anti-foam compound as necessary. Circulate for 48 hours or as recommended by the manufacture. Dispose of water in approved manner. Flush system and replace with clean water. Verify compatibility of chemicals used with existing chemical treatment program on remodel projects.

- G. Phase Three: Final flushing and rinsing: Flush and rinse until "potable water clear" and particles larger than 5 microns are removed. Operate valves to dislodge any debris in valve body. Dispose of water in approved manner.
- H. Submit status reports upon completion of each phase of work on each system.
- I. Special requirements, if any, are specified in the sections on each type of piping or in the section on Water Treatment Systems.

### 3.13 TESTING

- A. Test piping after installation with water hydrostatic pressure of 1-1/2 times operating pressure (150 psig minimum) and carefully check for leaks. Repair leaks and retest system until proven watertight.
- B. Do not insulate or conceal piping systems until tests are satisfactorily complete.
- C. If any leaks or other defects are observed, suspend the test and correct the condition at once. Repeat testing until leaks are eliminated and the full test period is achieved.
- D. The satisfactory completion of testing does not relieve the Contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories.

### 3.14 PIPE MARKERS

- A. Identify interior exposed piping and piping in accessible chases or plenums with Opti-Code Brady Pressure Sensitive Adhesive Pipe Markers, consisting of pipe marker and direction of flow arrow tape. Clean pipe prior to installation. Background colors of markers, arrows and tape for each type of system shall be the same. Meet ANSI/OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- B. Identify exterior and mechanical room piping with Snap Around pipe markers through 4-inch pipe and Strap Around markers 5-inch pipe and larger. Pipe markers consisting of pipe marker and direction of flow arrow tape; background colors of markers, arrows and type for each type of system shall be the same. Meet ANSI / OSHA standards and clearly identify each system. Provide minimum 2-1/4-inch letters through 4-inch pipe and 4-inch letters for 5-inch pipe and larger.
- C. Install identification in the following locations:
  - 1. both sides of penetrations through walls, floors and ceilings.
  - 2. Close to valves or flanges.
  - 3. Intervals on straight pipe runs not to exceed 50 feet
  - 4. Apply marker where view is obstructed.
- D. Pipe markers shall meet or exceed the specifications of the ASME A13.1 "Scheme for Identification of Piping Systems".

END OF SECTION

SECTION 23 21 13

HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating water and chilled water piping, valves and appurtenances, including fittings and strainers. Domestic hot water piping is specified in the Domestic Water Piping and Appurtenances section.

1.2 RELATED WORK

- A. Division 23 Mechanical:
  - 1. Pipe and Pipe Fittings - General
  - 2. Valves, Strainers and Vents
  - 3. Vibration Isolation
  - 4. Insulation

PART 2 - PRODUCTS

2.1 PIPE AND FITTINGS

- A. For pipe 2" and less in diameter, provide pipe conforming to ASTM A 53, Grade A or B, or ASTM A106 standard weight seamless, or electric-resistance welded black steel pipe. Furnish 150 lb. screwed malleable iron fittings conforming to ANSI B 16.3 for chilled water. Provide fittings conforming to ANSI B 16.4 for hot water.
- B. For pipe 2-1/2" in diameter and larger, provide pipe meeting the requirements of ASTM A 53, Grade A or B, or ASTM A 106 standard weight seamless, or electric-resistance welded black steel pipe with standard weight seamless steel welded fittings, satisfying ASTM A 234, Grade WPA or WPB, ANSI B16.9.

2.2 VALVES

- A. Refer to Section 23 05 23.
- B. Refer to Building Management and Control System.

2.3 WATER SPECIALTIES

- A. Automatic Air vents shall be float actuated high capacity air vent designed to purge free air from the system and provide shutoff at pressures up to 150 psig at a maximum temperature of 250 degrees F. The design of the high capacity air vent shall prevent air from entering the system if system pressure should drop below atmospheric pressure. The high capacity air vent shall purge free air at pressures up to 150 psig during normal system operation. The high capacity air vent shall be constructed of cast iron and fitted with components of stainless steel, brass, and EPDM.
  - 1. Acceptable Manufacturers: Bell & Gossett, Armstrong, Taco, and Wheatley.

PART 3 - EXECUTION

3.1 TESTING

- A. Test all piping systems to assure they are absolutely leak free.
- B. Apply a hydraulic pressure 1-1/2 times the operating pressure, 150 psig minimum, and check for leaks. Maintain test for a minimum of 24 hours. The piping system must remain absolutely tight during this period. The satisfactory completion of any test or series of tests will not relieve the contractor of responsibility for ultimate proper and satisfactory operation of piping systems and their accessories. The test should be observed by the Architect / Engineer before pressure is removed and water drained.

3.2 AIR HANDLING UNIT PIPING

- A. Provide a minimum of 12" of straight pipe at all coil piping connections.

HOT WATER AND CHILLED WATER PIPING, VALVES AND APPURTENANCES

3.3 AIR SEPARATOR

- A. Install full size drain to nearest floor drain.

END OF SECTION

SECTION 23 31 13

DUCTWORK

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Duct construction, support and accessories. Dimensions shown on the drawings are free area dimensions.

1.2 RELATED WORK

- A. Division 23 Mechanical
  - 1. Air Devices
  - 2. Air Handling Units
  - 3. Insulation
  - 4. Fans
  - 5. Testing, Balancing and Adjusting (TAB) of Environmental Systems
- B. Division 9 – Finishes, Painting and Color Coding

1.3 QUALITY ASSURANCE

- A. The intent of ductwork specifications is to obtain superior quality workmanship resulting in an installation that is absolutely satisfactory in both function and appearance. Provide ductwork in accordance with the specifications for each type of service.
- B. An approved contractor for this work under this division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 5 systems of comparable size and type that have served their owners satisfactorily for not less than 5 years.

1.4 GUARANTEE

- A. Guarantee ductwork for 1 year from the date of substantial completion. The guarantee covers workmanship, noise, chatter, whistling, or vibration. Ductwork shall be free from pulsation under conditions of operation.

1.5 CONTRACTOR COORDINATION

- A. Erect ducts in the general locations shown, but conform to structural and finish conditions of the building. Before fabricating any ductwork, check the physical conditions at the job site and make necessary changes in cross sections, offsets, and similar items, whether they are specifically indicated or not.
- B. Coordinate location of ductwork with structural members and Architectural drawings and requirements.

1.6 SHOP DRAWINGS AND SAMPLES

- A. Submit shop drawings of all ductwork layouts, including enlarged plans and elevations of all air handling equipment, and submit details of duct fittings, including particulars such as gauge sizes, welds, and configurations prior to starting work.
- B. Submit product data and sealing materials to be used.
- C. Submit sound attenuation data.
- D. Submit shop drawings in plan, elevation and sections, and three-dimensional view showing

equipment in mechanical equipment areas.

## PART 2 - PRODUCTS

### 2.1 STANDARDS AND CODES

- A. Except as otherwise indicated, sheet metal ductwork material and installation shall comply with the latest edition of SMACNA HVAC Duct Construction Standards. Air distribution devices (such as dampers) included in this specification shall comply with the latest applicable SMACNA Fire, Smoke and Radiation Damper Installation Guide for HVAC Systems and NFPA 90A.

### 2.2 DUCT MATERIAL AND CONSTRUCTION

- A. Except for the special ducts specified below use lock forming quality prime galvanized steel sheets or coils up to 60" wide. Stencil each sheet with gauge and manufacturer's name. Stencil coils of sheet steel throughout on 10' centers with gauge and manufacturer's name. Provide certification of duct gauge and manufacturer for each size duct.
- B. Rectangular low and medium pressure duct constructed of sheet metal in accordance with the latest edition of SMACNA HVAC Duct Construction Standards.
- C. Medium pressure oval and round ductwork shall be spiral seam. Spiral lock-seam SMACNA Type RL-1. Fittings shall be welded construction.
  - 1. Galvanized
- D. Low pressure round ducts shall be shop fabricated with snap lock longitudinal seams. Ducts shall be constructed for a minimum of 2" w.g. static pressure.
- E. Dishwasher Hood Exhaust System: Welded 304 Stainless steel.
- F. Shower Area Exhaust Systems: Welded 304 Stainless steel.
- G. Kitchen exhaust duct: Welded Black steel, minimum 16 gauge
- H. Natatorium Ductwork: 304 Stainless Steel

### 2.3 ACOUSTICAL DUCT

- A. Duct and fittings:
  - 1. Double wall acoustically treated.
  - 2. Annular space packed with fiberglass insulation.
  - 3. Perforated metal liner to provide specific acoustic impedance
  - 4. Insulation 1.0 pcf. 1 inch thick
  - 5. United McGill Acousti-K27 spiral lockseam or approved equal
  - 6. Material as indicated below:
    - a. Paintable Galvanized Steel
- B. Pressure rating and tests as specified for single wall ductwork.

### 2.4 DUCT SEALING OF SEAMS AND JOINTS

- A. Follow seal classification as indicated in Table 1-2 of SMACNA "HVAC AIR DUCT LEAKAGE TEST MANUAL". Use seal class A for 4" w.g. static. All longitudinal and transverse joints and seams shall be sealed by use of a fireproof, non-hardening, and non-migrating elastomeric sealant. With the exception of continuously welded joints and machine made spiral lock seams, joints and seams made air tight with duct sealer.
  - 1. Indoor applications – Foster 32-14
  - 2. Outdoor applications – Foster 32-17

### 2.5 FLEXIBLE DUCT LOW PRESSURE

- A. Construction:

1. Continuous galvanized spring steel wire helix, with reinforced metalized cover
    - a. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
  2. UL 181 Class I air duct label
  3. Reinforced vapor barrier jacket
  4. Rated for use at system pressure (6" wc minimum)
  5. Flexible duct connections from lateral taps to variable volume boxes or terminal boxes shall be rated at twice the maximum pressure rating of the medium pressure system.
- B. Fire hazard classification:
1. Flame spread rating 25 maximum.
  2. Smoke developed rating 50 maximum.
- C. Thermal characteristics:
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
  2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
  3. 2" minimum wall thickness insulation with 1" overlap
- D. Acceptable manufacturers:
1. Flexmaster
  2. Hart & Cooley
  3. Omniair
  4. Peppertree Air Solutions

## 2.6 FLEXIBLE DUCT MEDIUM/HIGH PRESSURE

- A. The duct shall be constructed of a heavy coated fiberglass cloth fabric supported by helical wound galvanized steel. The fabric shall be mechanically fastened to the steel helix without the use of adhesives.
- B. The internal working pressure rating shall be at least as follows with a bursting pressure of at least two times the working pressure:  
Positive: 12" w.g.  
Negative: 5" w.g.
- C. The duct shall be rated for a velocity of at least 5500 fpm.
- D. Suitable for operating temperature range of -20°F to +250°F.
- E. Factory insulate the flexible duct with fiberglass insulation.
1. R-6 BTU/hr/sq. ft./°F (when located in a conditioned plenum)
  2. R-8 BTU/HR/Sq.Ft./°F (when located in an unconditioned plenum)
  3. 2" minimum wall thickness insulation with 1" overlap
- F. Cover the insulation with a fire retarding polyethylene vapor barrier jacket having a permeance of not greater than 0.10 perms when tested in accordance with ASTM E96, Procedure A.
- G. Acceptable manufacturers:
1. Flexmaster
  2. Omniair
  3. Peppertree Air Solutions

## 2.7 FIRE DAMPERS

- A. Fire dampers for required wall ratings that are 95% minimum free area. Provide Type B or Type C UL dampers for low, medium and high-pressure rectangular, square or round ducts. Dampers shall be activated by a fusible link designed to react at 165°F. Install per manufactures recommendations to provide a UL assembly. Provide sealed sleeve to meet desired leakage performance.
- B. Acceptable Manufacturers:
1. Ruskin
  2. Prefco Products

3. Air Balance
4. Greenheck, Inc.
5. Nailor Industries
6. Pottorff

## 2.8 CEILING RADIATION DAMPERS

- A. Ceiling Radiation Dampers at location shown on plans constructed and tested in accordance with the current edition of UL555C of a minimum 22 gauge (0.8) blades, hinged in the center and held open with a 165° fusible link. Maximum blade height in the open position shall be 10" overall regardless of damper area. Maximum distance between blades held in the open position shall be 1-1/4" for units not requiring blade insulation and 1/4" for units with sheetrock blade insulation. Blades requiring radiation protection insulation shall utilize sheetrock. Refractory Ceramic or Mineral Wool Fiber is not allowed in the air stream. Radiation insulation outside of the air stream shall be Mineral Wool Fiber only. Ceramic Fiber Material is not approved for use. Units shall be constructed of a minimum 20-gauge (0.9) frame welded at all seams.
- B. Acceptable Manufactures
1. Ruskin
  2. Prefco
  3. Air Balance
  4. Phillips
  5. Safe-Air
  6. Nailor Industries

## 2.9 WALL LOUVERS

- A. Refer to schedule on drawings. Coordinate with Architectural Drawings.
- B. All louver frames shall be a minimum of 0.08" extruded aluminum. All blades shall be a minimum of 0.081" extruded aluminum. Beginning point of water penetration at 0.01 oz/sq.ft. Shall be a minimum of 800 ft/min.
- C. Provide all louvers with removable aluminum bird screen with 1/4" mesh.
- D. Louvers shall be AMCA-550 tested and approved.
- E. Acceptable manufacturers:
1. American Warming and Ventilation
  2. Arrow
  3. Greenheck
  4. NCA
  5. Pottorff
  6. Ruskin

## 2.10 VOLUME DAMPERS

- A. Manual balancing dampers that meet or exceed the following minimum construction standards:
1. Frame 16-gauge
  2. Blades 16-gauge
  3. Bearings corrosion resistant
  4. Concealed linkage
  5. Opposed blade dampers
- B. Acceptable manufacturer:
1. Ruskin Model MD-35 or approved equal, by
  2. Arrow
  3. American Warming and Ventilating
  4. Nailor Industries
  5. Pottorff

## 2.11 ACCESS DOORS



- A. Round spin-in door of galvanized steel.
  - 1. Fire proof sealing gaskets and quick fastening locking devices
  - 2. Insulated door
  - 3. Conform to the requirements of the NFPA
  - 4. Identification and use of each access door
  - 5. UL label to match the construction in which it is installed
  - 6. Cable attached to door and outer frame
  - 7. Low leakage Access Door
- B. Acceptable Manufacturer
  - 1. Flex master, Inspector Series
  - 2. Approved Equal

## 2.12 COMBINATION FIRE/SMOKE DAMPERS

- A. Combination fire/smoke dampers meeting the following requirements:
  - 1. Each combination fire/smoke damper shall be 1-1/2 hour fire rated under UL Standard 555, 4th Edition, and shall be further classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification. Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.
  - 2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16-gauge galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
  - 3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
  - 4. Each combination fire/smoke damper shall be equipped with a controlled 7 to 15 second heat-actuated release device. The electric EFL shall close and lock the fire/smoke damper during test, smoke detection, power failure or fire conditions through actuator closure springs. To prevent duct and HVAC component damage, the damper shall at all times be connected to the actuator for controlled closure in not less than 7 seconds and no more than 15 seconds. Instantaneous damper closure is unacceptable. After exposure to high temperature of fire, the damper must be inspected prior to reset to ensure proper operation. Release temperature is 165°F.
  - 5. Provide UL555S qualified electric actuator at 120 VAC.
  - 6. Provide air-foil type blades.
- B. Provide integral sleeves
- C. Acceptable Manufacturers:
  - 1. Ruskin
  - 2. Air Balance, Inc.
  - 3. Greenheck, Inc.
  - 4. Nailor Industries
  - 5. Pottoroff

## 2.13 SMOKE DAMPERS

- A. Smoke dampers meeting the following requirements.
  - 1. Each smoke damper shall be classified by Underwriters Laboratories as a leakage Rated Damper for use in smoke control systems under the latest version of UL555S, and bear a UL label attesting to same. The damper manufacturer shall have tested, and qualified with UL, a complete range of damper sizes covering all dampers required by this specification.

Testing and qualifying a single damper size is not acceptable. The leakage rating under UL555S shall be Leakage Class II.

2. The damper frame shall be a minimum of 16 gauge, galvanized steel, formed into a structural hat channel shape with tabbed corners for reinforcement, as approved in testing by Underwriters Laboratories. Bearings shall be integral high surface area non-electrolytic materials construction to incorporate a friction free frame blade lap seal, or molybdenum disulfide impregnated stainless steel or bronze oilite sleeve type turning in the damper frame. The dampers shall be opposed blade type. The blades shall be constructed with a minimum of 16 gauge, galvanized steel. The blade edge seal material shall be able to withstand 450°F. The jamb seals shall be flexible stainless steel compression type.
  3. As part of the UL qualification, dampers shall have demonstrated a capacity to operate (open and close) under HVAC system operation conditions, with pressures of at least 4" water gauge in the closed position, and 2,000 fpm air velocity in the open position.
  4. Provide UL555S qualified electric actuator at 120 VAC.
  5. Provide air-foil type blades.
- B. Provide integral sleeves.
- C. Acceptable Manufacturers:
1. Ruskin
  2. Air Balance, Inc.
  3. Greenheck, Inc.
  4. Nailor Industries
  5. Pottoroff

#### 2.14 DIFFUSER FITTINGS LOW PRESSURE TAPS

- A. Fitting shall meet or exceed the following minimum construction standards:
1. Conical with a base diameter two inches larger than the tap diameter.
  2. Construct fitting and damper of galvanized steel in accordance with ASTM A 527, G90 finish.
    - a. Fitting with a 3/16-inch high stop bead approximately 2-1/2-inches from the discharge end of the fitting
    - b. Provide the fitting with a butterfly damper, damper rod, end bearings and heavy duty locking quadrant.
    - c. Size the length of the straight section of the fitting to match the damper blade diameter. Center the damper blade in the straight section.
  3. Match the fitting body gauge to the SMACNA duct gauge, but not less than:
    - a. Through 8 inches: 26 gauge; Damper blade 22 gauge
    - b. 10 inches and 12 inches: 24 gauge; Damper blade 22 gauge
    - c. 14 inches and 16 inches: 22 gauge; Damper blade 22 gauge
    - d. 18 inches and 20 inches: 20 gauge; Damper blade 20 gauge
  4. Fasten damper blade to a 3/8 X 3/8 continuous square rod with minimum (2) galvanized U-bolts.
  5. Support the damper rod to the fitting with airtight nylon end bushings / bearings.
  6. Provide the damper with a self-locking regulator and handle.
  7. Provide a 2" sheet metal stand-off to extend the regulator.
  8. Flex duct grip area – 2 inches behind retaining bead
  9. Flex duct retaining bead – 1 inch from end
  10. Conical length of at least 3 inches
  11. Barrel length of at least 9 inches

#### 2.15 AUXILIARY DRAIN PANS

- A. 304 stainless steel, same gauge and same bracing or cross breaks as a duct with same dimensions. Sides of pan turned up to 1-1/2", all joints soldered watertight. Pan is to be large enough to complete cover drip lines of unit.

#### 2.16 DUCTWORK SUPPORTS ON ROOF

- A. Support ductwork on roof with Portable Pipe Hanger Model PHP-D fully adjustable height and width. Base material shall be high density / high impact polypropylene with UV inhibitors and anti-

oxidants. Provide with hot dip galvanized framing. Nuts and washers shall be hot dip galvanized.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Use construction methods and requirements as outlined in SMACNA HVAC Duct Construction Standards as well as SMACNA Balancing and Adjusting publications, unless indicated otherwise in the specifications. Refer to details on the drawings for additional information.
- B. Reinforce ducts in accordance with recommended construction practice of SMACNA. Provide additional reinforcement of large plenums as required to prevent excessive flexing and or vibration.
- C. Cross break or bead sheet metal for rigidity, except ducts that are 12" or less in the longest dimension.
- D. Where ducts pass through walls in exposed areas, install suitable escutcheons made of sheet metal angles as closers.
- E. At locations where ductwork passes through floors, provide watertight concrete curb around penetration.
- F. Support ducts where passing through floors with galvanized steel structural angles of adequate bearing surface.
- G. Metal or lined ductwork exposed to view through grilles, registers, and other openings shall be painted flat black. Do not install grilles, registers, or similar items until painting is complete.
- H. Fire Dampers shall be installed per manufacturer's recommendations to create a UL rated assembly.
- I. Install end bearing at all location where damper shaft penetrates duct wall.
- J. Clean duct to remove accumulated dust. Ducts shall be closed on ends between phases of fabrication to assure that no foreign material enters the ducts.

#### 3.2 DUCTWORK

- A. Construct rectangular ducts and round ducts in accordance with the latest SMACNA HVAC Duct Construction Standards. Use the static pressure specified on the air handling unit schedule or fan schedules as a minimum for duct construction. All ductwork between the variable volume air handling units and the terminal units shall be constructed to the medium pressure ductwork specification.
- B. Provide adjustable, galvanized splitter-dampers, pivoted at the downstream end with appropriate control device at each supply duct split.
- C. For branch ducts wider than 18", and when shown on drawings provide extractors with an appropriate control device at each rectangular zone or branch supply duct connection. Provide controllers for extractors. Branch ducts shall have a 45° angle in the direction of flow. Do not provide extractor at branch ducts to sidewall registers where the registers are within 10 feet of the main duct.
- D. Shop manufactured curved blade scoops may be used for branch duct takeoffs up to 18" wide. Taper scoop blade to the end, to prevent any sagging that may cut into, or damage duct liner if specified during operation.
  - 1. Construct shop manufactured scoops and splitter blades of galvanized sheet metal 2 full gauges heavier than equivalent sheet metal gauge of branch duct (up to 16 gauge).
  - 2. Check extractors, scoops and splitter blades thoroughly for freedom of operation. Oil bearing points before installing.
- E. Use pushrod operator with locking nut and butt hinges assembly.

- F. Provide opposed-blade volume dampers with an appropriate control device in each of the following locations:
1. Return air ductwork
  2. Outside air branch duct
  3. Exhaust branch duct
  4. Exhaust connections to hoods except kitchen grease hoods or equipment
  5. In each zone at multi-zone unit discharge installed downstream of duct mounted re-heat coils
  6. At each outside air and return air duct connection to plenum of constant volume units
  7. At discharge side of constant volume boxes
  8. Where otherwise indicated or required for balancing coordinate location of additional dampers required by TAB Contractor.
  9. Provide multi-blade dampers when blade width exceeds 12". Provide end bearing where damper shaft penetrates duct wall.
- G. Elbows:
1. Rectangular: Where square elbows are shown, or are required for good airflow, provide and install single-wall or airfoil turning vanes. Job-fabricated turning vanes, if used, shall be single-thickness vanes of galvanized steel sheets of the same gauge metal as the duct in which they are installed. Furnish vanes fabricated for the same angle as the duct offset. The use of radius elbows with a centerline radius of not less than 1-1/2 times the duct width may be provided in lieu of vaned elbows where space and air flow requirements permit.
  2. Round Oval Duct. Provide elbows with a centerline radius of 1-1/2 times the duct diameter or duct width. For round ducts, furnish smooth elbows or 5 piece, 90° elbows and 3 piece, 45° elbows.
- H. For control devices concealed by ceilings, furring, or in other inaccessible locations, furnish extension rods and appropriate recessed-type Young regulators, mounted on the surface of the ceiling or the furring, unless specified, or shown otherwise. Provide with chrome plated cover plates. Use only one mitered gear set for each control device.
- I. Install streamline deflectors at any point where dividing a sheet metal duct around piping or where other such obstruction is permitted. Where such obstructions occur in insulated ducts, fill space inside streamliner and around obstructions with glass fiber insulation.
- J. Insulated Flexible Duct:
1. Install in accordance with manufacturer's instructions, and the terms of its UL listing. Duct shall not exceed 6' in length. Make connections by use of sheet metal collars and stainless steel circular screw clamps. Clamps shall encircle the duct completely and be tightened with a worm gear operator to the point that will provide an airtight connection without unnecessary deformation of the duct. Provide one clamp on flexible duct and one clamp on external insulation. Vapor barrier jacket shall be tucked inside to conceal insulation material.
  2. Construct bends over 45° with sheet metal elbows.
- K. Duct Supports:
1. Horizontal ducts up to 40". Support horizontal ducts up to and including 40" in their greater dimension by means of #18 U.S. gauge galvanized iron strap hangers attached to the ducts by a minimum of two locations per side by means of screws, rivets or clamps, and fastened to inserts with toggle bolts, beam clamps or other approved means. Place supports on at least 8' centers. Use clamps to fasten hangers to reinforcing on sealed ducts.
  2. Horizontal ducts larger than 40". Support horizontal ducts larger than 40" in their greatest dimension by means of hanger rods bolted to angle iron trapeze hangers. Place supports on at least 8' centers in accordance with SMACNA Standards.
  3. Support vertical ducts where they pass through the floor lines with 1-1/2" x 1-1/2" x 1/4" angles for ducts up to 60". Above 60", the angles shall be increased in strength and sized on an individual basis considering space requirements.
  4. Supports shall be suspended from structural or by independent support. Do not support from structural bridging. Upper attachments should be selected with a safety factor of 4 or

5 times actual load conditions and subject to Engineers approval. Double wrap straps over open web of joist.

- L. Branch connections for medium pressure ductwork shall be made with a conical lateral. Field installed conical branch ducts shall be minimum 20-gauge galvanized sheet metal, "Everdur" welded and coated with "Galvabar".

### 3.3 PLENUMS

- A. Return air plenums shall be rectangular galvanized sheet metal ductwork.
- B. Fabricate plenums upstream of fan of 16-gauge material.
- C. Fabricate plenums upstream of filters minimum 18-gauge material.

### 3.4 FLEXIBLE CONNECTIONS

- A. Where ducts connect to fans or air handling units that are not internally isolated, make flexible airtight connections using "Ventglas" fabric. The fabric shall be fire-resistant, waterproof and mildew resistant with a weight of approximately 30 ounces per square yard. Provide a minimum of 1/2" slack in the connections, and a minimum of 2-1/2" distance between the edges of the ducts. Also, provide a minimum of 1" slack for each inch of static pressure on the fan system. Fasten fabric to apparatus and to adjacent ductwork by means of galvanized flats or draw bands. Where connections are made in outdoor locations, seal fabric to metal with mastic.

### 3.5 ACCESS DOORS

- A. Install ductwork access doors as noted below, arranged for convenient access. Stencil each door for specific use. Install access doors in each of the following locations:
  - 1. Fire Dampers
  - 2. Smoke Dampers
  - 3. Smoke/fire Dampers
  - 4. Outside Air Dampers
  - 5. Duct Mounted Coils (up-stream)
  - 6. Control Dampers
- B. Size access door 1" smaller than ductwork.
  - 1. Available Sizes: 8", 10", 12", 18", 24"
- C. Construct access door air tight, and conform to recommendations of NFPA and SMACNA.
- D. Demonstrate suitability of access for the intended purpose. Install multiple access doors as required.

### 3.6 DUCT LINING

- A. Install glass fiber acoustical lining where shown on drawings. Secure to duct surfaces with Foster 85-62 / 85-60 or Childers CP-125-1 / CP-127 adhesive and sheet metal fasteners on 12" centers. Coat exposed edges and leading edges of cross-joints with adhesive.
- B. Provide metal nosing that is either channeled or "Z" profiled or are integrally-formed from the duct wall securely installed over transversely oriented liner edges facing the air stream at fan discharge and at any interval of lined duct preceded by unlined duct.
- C. Refer to Insulation & Liner Detail on drawings for locations requiring liner to be installed.
- D. Do not install liner in multi-zone unit ductwork.

### 3.7 SEALING OF SEAMS AND JOINTS

- A. Seal supply, return, exhaust and outside air duct systems.

3.8 FLUES

- A. Provide and install flues for all gas fired equipment.
- B. Refer to plans for all related locations.
- C. Contractor is responsible for coordinating stack sizing, stack drains, stack test ports, stack termination fittings and all other required fittings with the selected equipment manufacturers.
- D. All fittings and accessories shall be manufactured by the flue manufacturer. The flue shall be installed per manufacturer's instruction.
- E. Terminate flues at height above roof to prevent flue gas from entering the building.

3.9 OUTSIDE AIR INTAKE SYSTEM

- A. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction. Grade horizontal duct 1/4" per lineal foot to drain toward the exterior louver.

3.10 CONNECTIONS TO LOUVERS

- A. Make watertight connections to all louvers. All material and fittings shall be 304 Stainless steel, welded joints, watertight construction sloped to bottom of louver. Lap duct to be over bottom louver blade where possible.
- B. Where plenums are installed on inside of louver, construct such that bottom of plenum will lap over bottom blade of louver to drain any water that may enter.

3.11 ACOUSTICAL DUCT

- A. Install in the following locations:
  - 1. Exposed STEM Lab and STEM Classroom
  - 2. And/or where indicated on the drawings

3.12 SCREENS

- A. Furnish and install screens on all duct, fan, etc., openings furnished by the Contractor that lead to, or are, outdoors; screens shall be No. 16 gauge, one-half inch (1/2") mesh in removable galvanized steel frame. Provide safety screens meeting OSHA requirements for protection of maintenance personnel on all fan inlets and fan outlets to which no ductwork is connected.

3.13 PLENUMS

- A. Construct plenums with galvanized steel framing members and galvanized sheet steel, cross braced and rigidly braced with galvanized angles. Gauges and bracing shall conform to SMACNA recommendations for ductwork of like sizes. Openings for fans, access doors, etc., shall be framed with galvanized steel angles.
- B. Provide access doors.

3.14 AUXILIARY DRAIN PANS

- A. Where coils that have a condensate drain are located above ceiling.

3.15 TESTING OF LOW PRESSURE DUCTWORK

- A. Test ductwork for leaks before concealing. Maximum allowable leakage is 5% of total airflow.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers and pressure vs CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.

- C. Mains: Test mains after risers and branches are tied in and all equipment set. Close runout connections and place fan in operation. Provide pressure in mains at 1-1/2 times design pressure. Visually inspect joints. Repair leaks detected by sound or touch. Release mains for completion after joints are tight.
- D. Ductwork down stream of terminal boxes, return, exhaust, and outside air ducts are to be visually inspected.

3.16 TESTING OF MEDIUM AND HIGH PRESSURE DUCT

- A. As the project progresses, test the ductwork in sections.
- B. Provide equipment necessary for performing tests, including rotary blower large enough to provide required static pressure at allowed CFM quantity, certified orifice section with proper papers, traceable serial numbers, and pressure vs. CFM leakage rate scale, U-tube gauge board complete with cocks, tubing, and inclined manometer for leakage rates.
- C. Finally as a complete system, test ductwork at a minimum of 2.5" with a maximum allowable leakage of 1% of the total design supply airflow.
- D. Test method as set forth in SMACNA "HVAC Duct Construction Standards".

END OF SECTION

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SECTION 23 31 14

FABRIC AIR DISPERSION SYSTEM

PART 1 - GENERAL

1.1 DESCRIPTION OF WORK

- A. Extent of non-metal ductwork is indicated on drawings and by requirements of this section.

1.2 QUALITY ASSURANCE

- A. Building Codes and Standards:
  - 1. Product must be Classified by Underwriter's Laboratories in accordance with the 25/50 flame spread/smoke developed requirements of MFPA 90-A and are also classified in accordance with ICC Evaluation Service AC 167.
  - 2. All product sections must be labeled with the logo and classification marking of Underwriter's Laboratories.
  - 3. Product must be treated with an EPA registered antimicrobial agent.

1.3 SUBMITTALS

- A. Product Data: Submit manufacturer's specifications on materials and manufactured products used for work of this section.
- B. Building Code Data: Submit UL file number under which product is Classified by Underwriter's Laboratories for both NFPA 90-A and ICC AC167.
- C. Submit manufacturer's documented design support information including duct sizing, vent and orifice location, vent and orifice sizing, length, and suspension. Submit parameters for design, including maximum air temperature, velocity, pressure and fabric permeability.
- D. Color selections
- E. Manufacturer's recommended suspension system

1.4 WARRANTY

- A. Manufacturer must provide a 10 Year Product Warranty for products supplied for the fabric portion of this system as well as a Design and Performance Warranty.

1.5 DELIVERY, STORAGE AND HANDLING

- A. Protect fabric air dispersion systems from damage during shipping, storage and handling.
- B. Where possible, store products inside and protect from weather. Where necessary to store outside, store above grade and enclose with a vented waterproof wrapping.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

Subject to compliance with requirements, choose one of the following:

- A. DuctSox Corporation
- B. Fabric-Air
- C. KE Fibertec
- D. Prihoda

## 2.2 FABRIC AIR DISPERSION SYSTEM

- A. Air diffusers shall be constructed of a woven fire retardant fabric complying with the following physical characteristics:
1. Fabric Construction: 100% Flame Retardant and treated with a machine wash-able anti-microbial agent from the manufacturer.
  2. Weight: 6.75 oz./yd<sup>2</sup> per ASTM D3776
  3. Fabric Porosity: 1.5 (+2/-1) cfm/ft<sup>2</sup> per ASTM D737, Frazier
  4. Temperature Range: 0 degrees F to 180 degrees F
  5. Fire Retardancy: Classified by Underwriters Laboratories in accordance with the flame spread/smoke developed requirements of NFPA 90-A and ICC AC 167.
  6. Antimicrobial agent shall be proven 99% effective after 10 laundry cycles per AATCC Test Method 100.
- B. Systems Fabrication Requirements:
1. Air dispersion and extended throws accomplished by reinforced orifices and permeable fabric. Reinforced orifices are to be installed to deep the integrity of opening and withstand laundry processes.
  2. Diameter, quantity, and location of reinforced orifices to be specified and approved by manufacturer.
  3. Inlet connection to metal duct via fabric draw band with anchor patches as supplied by manufacturer. Anchor patches to be secured to metal duct via zip screw fastener – supplied by contractor.
  4. Inlet connection includes zipper for easy removal/maintenance.
  5. Lengths to include required zippers as specified by manufacturer.
  6. System to include adjustable flow devices to balance turbulence, airflow and distribution as needed. Flow restriction device shall include ability to adjust the airflow resistance from 0.06 – 0.60 in w.g. static pressure.
  7. End cap includes zipper for easy maintenance.
  8. Fabric system shall include connectors to accommodate suspension system listed below.
  9. Any deviation from a straight run shall be made using a gored elbow or an efficiency tee. Normal 90 degree elbows to be 5 gores with the radius of the elbow 1.5 times the diameter.
- C. Systems Design Parameters:
1. Use fabric diffusers only for positive pressure air distribution components of the mechanical ventilation system.
  2. Do not use fabric diffusers in concealed locations.
  3. Fabric diffusers shall be designed from 0.25" water gauge minimum to 3.0" maximum, with 0.5" as the standard.
  4. Fabric air diffusers shall be limited to design temperatures between 0 degrees F and 180 degrees F (-17.8 degrees C and 82 degrees C).
  5. Design CFM, static pressure and diffuser length shall be designed or approved by the manufacturer.
- D. Suspension Hardware:
1. Internal Hoop Suspension (for duct diameters 10" to 48"): As a minimum, the system shall include a 3-row connection to fabric system at 10, 12, and 2 o'clock locations. The powder-coated aluminum hangers are secured and connected to a single (1 row) tension cable every 3'-0" and connect to the fabric system at the 10 and 2 o'clock locations with detachable D-Clasps. The fabric system will also have intermediate cable clips located at 12 o'clock and between the hangers to attach directly to the single tension cable system located 3" above top-dead-center location of the fabric system. Tension cable hardware to include cable, eye bolts, thimbles, cable clamps, and turnbuckles as required.
  2. Component options include:
    - a. Stainless steel cable
    - b. Adjustable Gripple Mid-Supports – incremental lengths of 5', 10', 15', 20' and 30'.

## PART 3 - INSTALLATION

### 3.1 INSTALLATION OF FABRIC AIR DISPERSION SYSTEM

#### FABRIC AIR DISPERSION SYSTEM

- A. Install approved suspension system in accordance with the requirements of the manufacturer. Instructions for installation shall be provided by the manufacturer with product.

3.2 CLEANING AND PROTECTION

- A. Clean air handling unit and ductwork prior to installation of the fabric duct system. Clean external surfaces of foreign substance which may cause corrosive deterioration of facing.
- B. Temporary closure: At ends of ducts which are not connected to equipment or distribution devices at time of ductwork installation, cover with polyethylene film or other covering which will keep the system clean until installation is completed.
- C. If fabric duct systems become soiled during installation, they should be removed and cleaned following the manufacturers standard terms of laundry.

END OF SECTION

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SECTION 23 34 16

FANS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install fans, including centrifugal, axial and propeller types, with supplemental equipment.

1.2 RELATED WORK

- A. Division 23 Mechanical:
  - 1. Ductwork
  - 2. Vibration Isolation
  - 3. Air Balance
  - 4. Electrical Provisions of Mechanical Work

1.3 PERFORMANCE

- A. Provide fan type, arrangement, rotation, capacity, size, motor horsepower, and motor voltage as shown. Fan capacities and characteristics are scheduled on the drawings. Provide fans capable of accommodating static pressure variations of +10% of scheduled design at the design air flow.
- B. Rate fans according to appropriate Air Moving and Conditioning Association, Inc. (AMCA), approved test codes and procedures. Supply fans with sound ratings below the maximums permitted by AMCA Standards. All fans provided must be licensed to bear the Certified Ratings Seal.
- C. Statically and dynamically balance all fans.
- D. Motors shall be sized so that they do not operate within the motor service factor.
- E. Fans shall be capable of 120% of the scheduled air capacities.
- F. All static pressures shown on schedules are external to fans. Manufacturer shall add damper and accessory losses to scheduled value before selecting fan.

1.4 SUBMITTALS

- A. Submit fan performance curves with system operating point plotted on curves.
- B. Submit manufacturer's printed installation instructions.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Cook
- B. Greenheck
- C. Penn Barry Ventilator
- D. Twin City Fans

2.2 PROTECTIVE COATINGS

- A. Manufacturer's Standard. Apply to fans, motors and accessories, the manufacturer's standard prime coat and finish, except on aluminum surfaces or where special coatings are required.
- B. Galvanizing. After fabrication of the parts, hot-dip coat surfaces that require galvanizing. Where

galvanizing is specified, a zinc coating may be used. After fabrication, apply the zinc coating and air-dry the coating to 95% pure zinc. Acceptable zinc coatings include Zincilate, Sealube, Amercoat, Diametcoat, or an approved equal.

## 2.3 SUPPLEMENTAL EQUIPMENT

- A. Motor Covers. Provide weatherproof motor covers for installations out of doors. Apply the same finish as used on the fan.
- B. Belt Drives:
  - 1. Unless otherwise specified for belt-driven fans, equip the fan motors with variable pitch sheaves. Select the sheave size for the approximate midpoint of adjustment and to provide not less than 20% speed variation from full open to full closed. Size drives for 150% of rated horsepower. Key the fan sheave to the fan shaft.
  - 2. Nonadjustable motor sheaves may be used for motor sizes over 15 horsepower, at the Contractor's option. However, if changing a nonadjustable sheave becomes necessary to produce the specified capacity, the change must be made at no additional cost.
  - 3. Provide belt guards and apply the same finish as used on the fan.
  - 4. Oil and heat resistant, nonstatic type belts.
  - 5. Bearings shall be designed and individually tested specifically for use in air handling applications. Construction shall be heavy duty, regreasable, ball type, in a pillow block, cast iron housing, selected for a minimum L50 life in excess of 200,000 hours at maximum catalog operating speed.
- C. Safety Disconnect Switch: Provide a factory-wired to motor, safety disconnect switch on each unit.
- D. Relief Vents and Air Inlets: Provide vents and inlets with aluminum frames and 1/2" mesh, galvanized bird screens. Include dampers where shown.
- E. Prefabricated Roof Curbs: Furnish prefabricated roof curbs as detailed. The minimum height is 14". Include a resilient pad on each roof curb so the equipment can be mounted on the top flange for proper seal. Coordinate roof slope and curb to ensure equipment is installed in level position. Provide double shell to protect insulation from damage.
- F. Where motorized damper is scheduled:
  - 1. The motor and damper are specified in the Building Management and Control System Specification.
- G. All fans are to be provided with a durable, deep etched, .025" thick, factory installed aluminum identification plate with the following information. Plates are to be furnished with four mounting holes.
  - 1. Fan mark as indicated on the Contract Drawings.
  - 2. Serial number
  - 3. Model number
  - 4. Capacity (CFM) and static pressure.
  - 5. Motor HP
  - 6. Motor Amps
  - 7. Manufacturer
  - 8. Motor phase
  - 9. Number of Belts/Make/Size
  - 10. Motor volts
- H. Utility Vent Set Fans, provide minimum 3/4 inch threaded coupling drain connection at lowest point of housing.

## 2.4 VENTILATION AND EXHAUST FANS

- A. Provide the ventilation and exhaust fans shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Provide each belt driven fan with approved, totally enclosed belt guard.

- D. Provide approved safety screen where inlet or outlet is exposed.
- E. Provide duct flanges where required for connections.
- F. Furnish kitchen hood exhaust fans with vented curb extension that meets NFPA 96, cleanout port, grease tap, curb seal, drain connection and hinge kit.
- G. Furnish supply fans with 1" aluminum, washable filter section.

## 2.5 ROOFTOP VENTILATION AND EXHAUST SYSTEMS

- A. Provide the rooftop ventilation and exhaust systems shown on the drawings.
- B. Provide each motor with internal overload protection.
- C. Components:
  - 1. Aluminum, stainless steel or plastic coated bird guard.
  - 2. Screws and fasteners of stainless steel or nonferrous material.
  - 3. All aluminum construction unless indicated otherwise on fan schedule.
- D. Welded construction, corrosion resistant fasteners, minimum 16 gauge marine allow aluminum.
- E. Aluminum base shall be continuously welded curb cap corners.

## 2.6 GRAVITY ROOF-TOP INTAKE AND RELIEF VENTS

- A. Provide the rooftop intake and relief vent systems shown on the drawings.
- B. Provide with aluminum, stainless steel or plastic coated bird guard.
  - 1. Screws and fasteners of stainless steel or nonferrous material
  - 2. All aluminum construction
- C. Welded construction, corrosion resistant fasteners, minimum 16-gauge marine alloy aluminum.
- D. Aluminum base shall be continuously welded curb cap corners.

## 2.7 OSCILLATING AIR CIRCULATOR FAN

- A. three speed CFM Low 1657 – CFM Medium 2060 – CFM High 3100
- B. Totally enclosed motor voltage – 120 Voltage – 60 Hz
- C. Cast Aluminum 20-inch diameter, three blade fan with OSHA Guard
- D. Wall Mounted
- E. Factory wired 10', 3 conductor with ground molded plug
- F. Acceptable Manufacturer: Dayton 4PRV7 or approved equal

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Install fans according to the manufacturer's instructions and in the locations shown on the drawings. Ensure fan location is installed at minimum distance from roof edge to meet code requirements.
- B. Do not operate fans or fan powered devices for any purpose until ductwork is clean, filters in place, bearings lubricated and the fan has been run under observation.
- C. Roof mounted fans and gravity roof-top intake and relief vents shall be secured to the curb with stainless steel lag screws at a minimum of 6-inches on center. Follow manufacturer's installation

instructions if they are more stringent. Install roof mounted equipment in a level position. Units shall be seated on properly sized curb. Gap between base of the fan and top of the curb shall be sealed with neoprene 1" x 1/4" gasket. Gasket shall be glued or attached with pressure sensitive adhesive.

- D. Install curbs and equipment in level position.
- E. Ceiling mounted in-line centrifugal blowers
  - 1. Shall be suspended from structure with 1/2-inch zinc plated all-thread rods secured to structure.
  - 2. Provide sub-structure where required.
  - 3. Mount bottom of fan no more than 18-inches above the finished ceiling height.

### 3.2 EXTRA MATERIALS

- A. Provide two sets of belts for each fan, not including the set installed on the fans. Tag set to identify fan.

END OF SECTION



SECTION 23 37 13

AIR DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air distribution devices, including grilles, diffusers, registers, dampers, and extractors.

1.2 RELATED WORK

- A. Division 23 Mechanical.
  - 1. Ductwork.
  - 2. Air Balance.
  - 3. Electrical Requirements for Mechanical Work.

1.3 COOPERATION WITH OTHER TRADES

- A. Coordinate this work with work under Division 26 Electrical, to ensure that intended functions of lighting and air systems are achieved.

1.4 SUBMITTALS

- A. Submit product data for outlets, grilles, registers, control devices, and similar equipment for review prior to placement of purchase order.
- B. Submittal shall include performance sheet for each air device type. Performance sheet shall include NC levels, throw, and total pressure loss at various air flows.

1.5 FINISHES

- A. Paint exposed devices with factory standard prime coat, or factory finish coat, as specified.

PART 2 - PRODUCTS

2.1 DIFFUSERS, GRILLES AND REGISTERS - Refer to Drawing Schedule.

2.2 ACCEPTABLE MANUFACTURERS

- A. Titus.
- B. Krueger.
- C. Nailor Industries.
- D. Price
- E. Metal-Aire

2.3 ACCESSORIES

- A. Supply Grille Extractors. Provide supply grilles with an air control device capable of positively regulating the volume of air extracted from the supply duct.  
  
Select extractors similar to Titus Model AG25, tight-closing in the minimum position. Include a key-operated or worm-gear adjusting mechanism to facilitate positioning from the grille opening. Where adjustment is not accessible at the grille opening, provide a square control rod equipped with a locking quadrant.
- B. Mounting Frames. Provide each grille or register not equipped with a removable core with a

companion, all-purpose mounting frame constructed like grille frame to facilitate installation and removal of the grille or register without marring adjacent mounting surfaces.

1. Furnish frames with 1/2" thick sponge rubber gasket to prevent air leakage.
2. Provide a frame that neatly fits the grille. Mounting frames will not be required for grilles or registers mounted directly on exposed ductwork.

### PART 3 - EXECUTION

#### 3.1 INSPECTION

- A. Do not install ceilings adjacent to fixtures until installation of fixtures, air supply assemblies, return-air blank-off strips and flexible duct have been approved. Remove and reinstall any part of the installation found incorrect.

#### 3.2 INSTALLATION

- A. Louvered diffuser outlets mount tight against the ceiling. Fasten outlets to ductwork with sheet metal screws. For perforated diffusers, attach the frame assembly by a concealed hinge assembly to an outer frame compatible with the type of ceiling on which the diffuser is installed.

END OF SECTION

SECTION 23 41 00

AIR FILTRATION

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air filters and air filter gauges.

1.2 RELATED WORK

- A. Division 23 Mechanical.

1.3 SUBMITTALS

- A. Submit manufacturer's product data sheets and capacity information as specified.
- B. Submit recommended Dirty Filter pressure drop.

PART 2 - PRODUCTS

2.1 MEDIUM EFFICIENCY AIR FILTERS (OUTSIDE AIR HANDLING UNIT)

- A. The filter cells:
  - 1. Pleated media.
  - 2. Disposable type.
  - 3. Contain not less than 4.6 sq. ft. of filtering media per square foot of face area.
  - 4. 16 pleats per linear foot of filter.
  - 5. 2" thick.
  - 6. MERV 13
- B. Media of reinforced nonwoven cotton fabric treated with adhesive and continuously laminated to a supporting steel wire grid conforming to the configuration of the pleats.
  - 1. Seal the media pack in a chipboard frame.
- C. Rated average dust spot efficiency of not less than 36%.
  - 1. Average synthetic arrestance in excess of 93% when tested in accordance with the ASHRAE 52-68 test standard.
- D. Filter capable of operating with variable face velocities up to 500 fpm without impairing efficiency.
- E. Initial resistance to air flow:
  - 1. 300 fpm - 0.12" WG.
  - 2. 500 fpm - 0.28" WG.
- F. UL listed with Class II rating.
- G. Provide one spare set for a complete change, in original cartons, for Owner's use during the warranty period.

2.2 AIR FILTERS (AIR HANDLING UNIT)

- A. The filter cells:
  - 1. Permanent 2" filter frame with renewable media.
  - 2. 18-gauge galvanized steel holding frame.
  - 3. 11-gauge galvanized steel wire grids to support the media.
  - 4. Front grid hinged and secured with a latch.
- B. The renewable viscous coated glass fiber media:
  - 1. Graduated density from front to back.
  - 2. Initial resistance not to exceed 0.17" WG at 500 fpm velocity.

AIR FILTRATION

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Central Middle School Renovations  
Galveston ISD  
Galveston, Texas

- 3. UL listed Class II.
  - 4. MERV 8 Orange media with heavy dry tackifier.
- C. Spare filter:
- 1. Provide the following material to the Owner for use during the warranty period.
    - a. Sufficient media of each thickness, in original cartons, for a complete change.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install the filters in accordance with the manufacturer's instructions.

END OF SECTION

SECTION 23 73 13

AIR HANDLING UNITS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install air handling units with casing, fans, coils, filters, and special items.

1.2 RELATED WORK

- A. Division 23 Mechanical
1. Air Balance
  2. Ductwork
  3. Controls
  4. Electrical Provisions of Mechanical Work
  5. Air Filtration
  6. Heating and Cooling Coils
  7. Other applicable sections

1.3 PERFORMANCE

- A. Unit capacities and characteristics as indicated.
1. Units must be certified in accordance with ARI Standard 430-66.
  2. UL 1995 certification for safety including electric heat.
  3. ARI 430 listed and meet NFPA 90A requirements.

1.4 SHOP DRAWINGS

- A. Indicate assembly, unit dimensions, weight loading required clearances, construction details, field connection details, and electrical characteristics and connection requirements.
- B. Submit fan performance curve for each unit:
1. Plot fan volume against static pressure, horsepower, and efficiency.
  2. Show point of rating based on static requirements of the system.
  3. Chart of specific sound power level at each octave band center frequency.
  4. For variable volume units, plot fan volume over entire range.
- C. Submit for review a unit internal static pressure loss calculation.
1. Provide an itemized list of static pressure loss at the scheduled CFM for each unit component including and not limited to:
    - a. Coils
    - b. Dirty filters
    - c. Fan and unit system effect
    - d. Cabinet and cabinet inlet and outlet
    - e. Unit mounted dampers
  2. If a unit mounted outside air pretreatment section without supply fan, "piggyback" is specified:
    - a. Provide an itemized static pressure loss as indicated above.
    - b. Determine losses for unit configuration, i.e. parallel or series.
    - c. Include losses in the primary unit internal static pressure required by configuration.
  3. The air handling unit schedule indicates static pressure external to the unit and does not include any losses associated with the air handling equipment.

1.5 ENVIRONMENTAL REQUIREMENTS

- A. Do not operate units until ductwork is clean, filters are in place, bearings lubricated, condensate properly tapped, piping connections verified and leak tested, belts aligned and tensioned, all shipping braces have been removed, and fan has been tested under observation.

AIR HANDLING UNITS

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1.6 DELIVERY, STORAGE AND HANDLING

- A. Inspect for transportation damage and store in a clean, dry location. Protect from weather and construction traffic.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Carrier (39CC)
- B. Temtrol (ITF)
- C. Trane (Custom)

2.2 MISCELLANEOUS REQUIREMENTS

- A. Provide factory assembled units. Large units may be shipped in sections, at contractor's option, to enable entrance to building, or for oversize shipping reasons only.
- B. Furnish units with sealing and fastening hardware supplied by the manufacturer. Include written instructions needed to complete field assembly of the components.
- C. Provide units designed and constructed so that coils, panels, fan housing and fans can be removed without affecting the structural integrity of the unit.
- E. Provide full perimeter welded double bottom base under units constructed of heavy gauge galvanized steel (minimum 14 gauge) and intermediate cross members to assure unit integrity. Provide minimum size base rail to ensure proper trapping and slope of condensate drain (minimum 6 inch from bottom of drain opening). Base shall be insulated with 2" thick r-13 closed cell spray foam insulation.
- F. Provide factory installed removable hinged access doors in the following locations:
  - 1. Entering side of all coils to allow for cleaning of coils on both sides of unit.
  - 2. Each side of filter compartment to allow changing of filters from either side.
  - 3. Each side of motor compartment to allow motor and isolation access.
  - 4. Each side of condensate drain pan to allow for cleaning and inspection.
  - 5. Swing the doors against the casing static pressure.
- G. Provide all coil modules, including heating coil modules, with stainless steel drain pans to facilitate cleaning and maintenance of the coils. Drain pan to extend 10" minimum downstream of cooling coil.
- H. Provide coils with 304 stainless steel casings, end plates, tube supports and top & bottom plates.
- I. Units shall meet ASHRAE III Class 6 Low Leakage Standard. Casing shall have less than a 1% leakage rate at plus or minus 8 inches W.G.
- J. Provide units with a low velocity angled filter section unless otherwise specified.
- K. All cooling coils and heating coils shall be epoxy coated.

2.3 BLOW THROUGH AIR HANDLING UNIT (ZONE UNIT)

- A. Provided with:
  - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
  - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
  - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
  - 1. Sized for 50% overload.

- C. Motors and Control:
1. Totally enclosed, fan cooled, Variable speed, 1750 rpm Maximum.
  2. Maximum operating point of 70 Hz.
  3. Minimum 90% nominal efficiency at loads of 70%-100%.
  4. Premium efficiency inverter duty
  5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
  6. +/- 10% voltage utilization range to protect against voltage variation.
  5. Cast iron frame and end plate
  6. Forged steel lifting eye
  7. Oversized conduit box with ground lug
  8. Provide with factory installed shaft grounding rings by Aegis
  9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
1. Single width, single inlet, backward curved welded aluminum plenum fan.
  2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
  3. Tested after being installed in the fan sections.
  4. Selected for the design air quantities and pressure of the system.
  5. Mounted on a common shaft if multiple wheels.
  6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
  7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- G. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.
- H. Insulation, vapor barriers, facings and adhesives shall have:
1. Flame spread not higher than 25.
  2. Smoke developed rating not higher than 50.
- I. Unit casing panels shall be a minimum of 2" double wall construction with solid galvanized exterior and solid galvanized interior. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042-inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections. Exterior liner shall be constructed from a minimum of 16-gauge galvanized steel and interior liner shall be constructed from a minimum of 20-gauge galvanized steel. Exterior liner shall be painted to meet or exceed a 2,000 hour salt spray resistance.
1. Condensation on the exterior of the air handling units is not acceptable.
- J. Filter section:
1. Constructed with substantial hinges.
  2. Neoprene gasketing.
  3. Permanent quick release latching devices.
  4. Air handling unit shall be provided with renewable media filter frames. Refer to specification 23 41 00 for additional information.
- K. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.

- L. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Provide a painted factory installed equalizing grid on the entering side of the first coil after the fan section.
- N. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

#### 2.4 DRAW THROUGH AIR HANDLING UNIT (OUTSIDE AIR)

- A. Provided with:
  - 1. Non-Overloading direct drive plenum fans. Provide minimum number of fans as indicated on drawings.
  - 2. Insulated sheet metal cabinet with removable panels for access to the interior.
  - 3. Hinged double wall doors with two-step safety handles.
- B. Drive assembly:
  - 1. Sized for 50% overload.
- C. Motors and Control:
  - 1. Totally enclosed, fan cooled, Variable speed, 1750 rpm Maximum.
  - 2. Maximum operating point of 70 Hz.
  - 3. Minimum 90% nominal efficiency at loads of 70%-100%.
  - 4. Premium efficiency inverter duty
  - 5. NEMA B design, with Class B insulation, capable to operate continuously at 104 deg F without tripping overloads.
  - 6. +/- 10% voltage utilization range to protect against voltage variation.
  - 5. Cast iron frame and end plate
  - 6. Forged steel lifting eye
  - 7. Oversized conduit box with ground lug
  - 8. Provide with factory installed shaft grounding rings by Aegis
  - 9. Motor selected so that the brake horsepower required to deliver the design air quantity at the system static pressure will not exceed the motor nameplate rating.
- D. Supply Fans:
  - 1. Single width, single inlet, backward curved welded aluminum plenum fan.
  - 2. Statically and dynamically balanced to a BV-3 per AMCA 204 test standard.
  - 3. Tested after being installed in the fan sections.
  - 4. Selected for the design air quantities and pressure of the system.
  - 5. Mounted on a common shaft if multiple wheels.
  - 6. The fan shall be rated in accordance with AMCA 210 for performance and AMCA 260 for sound.
  - 7. Minimum of Class II fan.
- E. Fans selected with isolation shall be internally isolated with spring isolators. A flexible connection shall be installed between fan and unit casing to ensure complete isolation. Flexible connection shall comply with NFPA 90A and UL 181 requirements. If fans and motors are not internally isolated, then the entire unit shall be externally isolated from the building, including supply and return duct work, piping, and electrical connections. External isolation shall be furnished by the installing contractor to avoid transmission of noise and vibration through the ductwork and building structure.
- F. Select fan to operate at or near its maximum efficiency point when handling the required air quantity and static pressure.
- G. Stainless steel condensate pan with positive slope in all directions to outlet. Line the condensate drain pan with minimum 1-1/2" waterproof insulation.



- H. Insulation, vapor barriers, facings and adhesives shall have:
  - 1. Flame spread not higher than 25.
  - 2. Smoke developed rating not higher than 50.
- I. Unit casing panels shall be a minimum of 2" double wall construction with solid galvanized exterior and **solid 316 stainless steel interior**. Panels shall have a minimum thermal resistance of R-13. The casing shall not exceed 0.0042-inch deflection per inch of panel span at 1.5 times the design static pressure up to a maximum of +8 inches in all positive pressure sections and -8 inches in all negative pressure sections. Exterior liner shall be constructed from a minimum of 16-gauge galvanized steel and interior liner shall be constructed from a minimum of 20-gauge 316 stainless steel. Exterior liner shall be painted to meet or exceed a 2,000 hour salt spray resistance.
  - 1. Condensation on the exterior of the air handling units is not acceptable.
- J. Filter section:
  - 1. Constructed with substantial hinges.
  - 2. Neoprene gasketing.
  - 3. Permanent quick release latching devices.
  - 4. Arranged to accommodate the 2" thick pleated filters as specified.
  - 5. Filter racks shall be constructed from 316 stainless steel.
- K. Cooling coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- L. Heating coils as specified. Extend drain and vent piping through cabinets. Provide grommets at all pipe penetrations through cabinets.
- M. Provide a factory installed equalizing grid on the entering side of the first coil after the fan section.
- N. Factory dynamic fan balancing shall be conducted from 16Hz to 60Hz to identify and eliminate critical speeds to ensure stable operation through the entire operating range of the fan and drive assembly. Field fan balancing is not acceptable. Forward factory balancing test report to Engineer upon request.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install air handling units according to manufacturer's instructions.
- B. Provide additional drive packages as required by the Testing and Balancing firm.
- C. Air leaks detectable by sound or touch are to be corrected.
- D. Air handling units are to be properly supported to prevent flexing, bending, or distorting base rails.
- E. All coils are to be cleaned prior to substantial completion if units are used during construction.
- F. Clean all air handling units and return to original manufacturer's condition prior to substantial completion. Vacuum clean all debris from inside air handling equipment.
- G. Install piping to unit with full size 6-inch-long dirt leg with 1/2" valve at bottom for cleaning.
- H. Provide for positive gravity drainage of coil condensate. Pipe full size of unit connection.
- I. Adjust fan drives as required to obtain scheduled capacities as directed by the Test and Balance Firm to include sheave and belt replacement.
- J. Align belts to eliminate wear and vibration of belts.
- K. Verify correct drainage of condensate from condensate pan.
- L. Verify correct rotation of fan and wiring of motor.

- M. Lubricate all greaseable ball bearings with manufacturer's suggested lubricant.
- N. Replace filters as required if units are used during construction.
- O. Provide piping installation so that after piping is completed and insulated there is full access to service unit and remove fan housing. Piping to coils shall not block fan section access or cause damage to piping insulation during access.

### 3.2 IDENTIFICATION

- A. Furnish each unit with a durable, deep etched, .025" thick, factory installed aluminum identification plate, permanently mounted with the following information:
  - 1. Unit identification as indicated on Contract Drawings.
  - 2. Serial Number.
  - 3. Model Number.
  - 4. Capacity (CFM) and static pressure.
  - 5. Motor HP.
  - 6. Unit power supply: Volts / PH / Amps.
  - 7. Supply Fan Type.
  - 8. Coil GPM and pressure drop.
  - 9. Sales Order #.
  - 10. Date unit manufactured.

END OF SECTION

SECTION 23 82 16

HEATING AND COOLING COILS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install heating and cooling coils.

1.2 SUBMITTALS

- A. Submit manufacturer's product data sheets and unit capacity information as specified.

1.3 RELATED WORK

- A. Division 23 Mechanical.
1. Air Handling Units.
  2. Fan Coil Units.
  3. Weatherproof Roof Mounted Air Handling Units.
  4. Ductwork.
  5. Terminal Boxes.

PART 2 - PRODUCTS

2.1 HOT WATER COILS

- A. Hot water coils:
1. Constructed of a minimum of 5/8" OD copper tubes with a minimum tube thickness of 0.020" and aluminum fins.
  2. Fins shall be constructed from aluminum with a minimum thickness of 0.008" with a maximum of 10 fins per inch.
  3. Designed and circuited for hot water.
    - a. Maximum temperature 200°F.
- B. Where coils are installed in fan powered VAV boxes, unit heaters and other locations where the incoming air is not filtered, the maximum approved fin spacing is 8 fins per inch.
- C. Non-trapping circuit design:
1. Working pressure 200 psi
  2. Tappings for drain and air vent
- D. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil.
1. Positioned to permit accurate pressure readings.
- E. Coils shall be constructed in casings as required for installation.

2.2 CHILLED WATER COILS

- A. Chilled water coils:
1. Constructed of a minimum of 5/8" OD copper tubes with a minimum tube thickness of 0.020" and aluminum fins.
  2. Fins shall be constructed from aluminum with a minimum thickness of 0.008" with a maximum of 10 fins per inch.
  3. Designed and circuited for chilled water
  4. Minimum of six rows
- B. Non-trapping circuit design:
1. Working pressure 200 psi.
  2. Tappings for drain and air vent.
- C. Provide a Peterson Pete's Plug with retainer strap on the inlet and outlet of each coil. Position to permit accurate pressure readings.

HEATING AND COOLING COILS

- D. Coils shall be constructed in casings as required for installation.
- E. Where coils are stacked, provide intermediate drain pans with drop tubes to drain condensate to the main drain pan without flooding the lower coil.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install the duct heaters in accordance with the manufacturer's Installation, Start-Up and Service Instructions.

END OF SECTION

SECTION 26 01 05

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile electrical product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare electrical operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit 3 copies of complete manual in final form.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Architect / Engineer's stamp of acceptance (including re-submittals), submit for review 1 copy of the first draft of the Electrical Operating and Maintenance Manual. This copy shall contain as a minimum:
  - 1. Table of Contents for each element
  - 2. Contractor information
  - 3. All shop drawings, coordination drawings and product data, bearing the Architect / Engineer's stamp of acceptance.
  - 4. All parts and maintenance manuals for items of equipment
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates)
  - 9. Control operations / equipment wiring diagrams
  - 10. Coordination Drawings
  - 11. Schedule of Lamps, Light Engines
  - 12. Schedule of Ballasts and Drivers
  - 13. Schedule of Fuses
  - 14. Other required operating and maintenance information that are complete.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the (3) completed manuals in final form to the Architect / Engineer.
  - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.
  - 2. Include all specified data, test reports, drawings, dated warranties, certificates, along with other materials and information.
- D. The Architect / Engineer shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Architect / Engineer. The manuals will not be retransmitted.
- F. Three complete manuals shall be delivered to the Owner prior to substantial completion.

PART 2 - PRODUCTS

2.1 BINDERS

- A. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
- B. Minimum ring size: 1"; Maximum ring size: 3".

ELECTRICAL OPERATING AND MAINTENANCE MANUALS

- C. When multiple binders are used, correlate the data into related groupings.
- D. Label contents on spine and face of binder with full size insert. Label under plastic cover.

### PART 3 - EXECUTION

#### 3.1 ELECTRICAL OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals:
  - 1. Prepare data in form of an instructional manual for use by Owner's personnel.
  - 2. Format:
    - a. Size: 8-1/2" x 11"
    - b. Text: Manufacturer's printed data or neatly typewritten.
  - 3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  - 4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  - 5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable
    - c. Identity of general subject matter covered in the manual.
  - 6. Binder as specified
- B. Content of Manual:
  - 1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement
    - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
  - 2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information.
  - 3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  - 4. Written text as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  - 5. Copy of each warranty, bond and service contract issued
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  - 6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
  - 1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts:

#### ELECTRICAL OPERATING AND MAINTENANCE MANUALS

- 1) Function, normal operating characteristics, and limiting conditions.
    - 2) Performance curves, engineering data and tests.
    - 3) Complete nomenclature and commercial number of replaceable parts.
  - b. Operating procedures:
    - 1) Start up, break-in, routine / normal operating instructions
    - 2) Regulation, control, stopping, shut down and emergency instructions
    - 3) Summer and winter operating instructions
    - 4) Special operating instructions
  - c. Maintenance procedures:
    - 1) Routine operations
    - 2) Guide to trouble-shooting
    - 3) Disassembly, repair and reassembly
    - 4) Alignment, adjusting and checking
    - 5) Routine service based on operating hours
  - d. Servicing and lubrication schedule
    - 1) List of lubricants required
  - e. Manufacturer's printed operating and maintenance instructions.
  - f. Copies of typed circuit directories of panel board to reflect actual room graphics numbers and room names (not architectural room numbers from the drawings).
    - 1) Electrical
    - 2) Controls
    - 3) Communications
  - g. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
    - 1) Predicted life of part subject to wear
    - 2) Items recommended to be stocked as spare parts
  - h. Schedule of fuses
  - i. Complete equipment field accessible internal wiring diagrams
  - j. Schedule of lamps
  - k. Schedule of ballasts
  - l. Each Contractor's coordination drawings
  - m. List of original manufacturer's spare parts and recommended quantities to be maintained in storage
  - n. Other data as required under pertinent sections of the specifications
2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
4. Provide complete information for products specified in Division 26.
5. Provide certificates of compliance as specified in each related section.
6. Provide start up reports as specified in each related section.
7. Provide signed receipts for spare parts and material.
8. Provide training report and certificates.

END OF SECTION

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SECTION 26 05 00

ELECTRICAL GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, and Supplementary Conditions, applicable provisions of Division 1 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 26 Electrical.
- B. Applicable provisions of this section apply to all sections of Division 26, Electrical.

1.2 CODE REQUIREMENTS AND FEES

- A. Perform work in accordance with applicable statutes, ordinances, codes and regulations of governmental authorities having jurisdiction.
- B. Electrical work shall comply with applicable inspection services:
  - 1. Underwriters Laboratories
  - 2. National Fire Protection Association
  - 3. State Health Department
  - 4. Local Municipal Building Inspection Department adopted codes with amendments
  - 5. National Electrical Code with local amendments
  - 6. State Regulatory Agencies
  - 7. Where the project is located outside a municipal jurisdiction, and has no municipal inspection services, the National Electrical Code with amendments of the municipality with extraterritorial jurisdiction shall govern.
  - 8. Where the project is located outside any municipal jurisdiction, including extraterritorial jurisdictions, the National Electrical Code with local adopted amendments of the largest municipality located in the same county or parish shall govern.
  - 9. International Energy Conservation Code
  - 10. National Electrical Safety Code
- C. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- D. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- E. Obtain all permits required.

1.3 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
  - 1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
  - 2. Able to furnish evidence of having contracted for and installed not less than 3 systems of comparable size and type that has served their Owners satisfactorily for not less than 3 years.

1.4 REFERENCE SPECIFICATIONS AND STANDARDS

- A. Materials which are specified by reference to Federal Specifications; ASTM, ASME, ANSI, APWA, or AWWA Specifications; Federal Standards; or other standard specifications must comply with latest editions, revisions, amendments or supplements in effect on date proposals are received. Referenced specifications and standards are minimum requirements for all equipment, material and work. In instances where specified capacities, size or other features of equipment, devices or materials exceed these minimums, meet specified capacities.
- B. Use electrical materials and equipment that is constructed and tested in accordance with the standards of NEMA, ANSI, ASTM, or other recognized commercial standard. If materials and equipment is labeled, listed, or recognized by any Nationally-Recognized Testing Laboratory (NRTL) acceptable to the Occupational Safety and Health Administration (OSHA), then provide NRTL-labeled, listed, or recognized material and equipment. Acceptable NRTLs include but are not limited to:
  - 1. Underwriters Laboratories, Inc. (UL)
  - 2. Factory Mutual Research Corp. (FMRC) (also referred to as "Factory Mutual Global," or "FM Global")
  - 3. Intertek Testing Services NA, Inc. (ITSNA, formerly ETL)
  - 4. Canadian Standards Association (CSA)
  - 5. A complete listing of acceptable NRTLs is published on the OSHA website at <http://www.osha.gov/dts/otpc/nrtl/>.
- C. Where material and equipment is not labeled, listed, or recognized by any NRTL, provide a manufacturer's Certificate of Compliance indicating complete compliance of each item with applicable standards of NEMA, ANSI, ASTM, or other recognized commercial standard.
- D. Do not install or use electrical material or equipment for any use other than that for which it was designed, labeled, listed, or identified unless formally approved for such use by the Owner's AHJ. This *National Electrical Code®* requirement is re-stated for emphasis.
- E. Codes and Standards applicable to this Division:
  - 1. ANSI – American National Standards Institute
    - a. ANSI Z535.1, Safety Colors
    - b. ANSI Z535.2, Environmental and Facility Safety Signs
    - c. ANSI Z535.3, Criteria for Safety Symbols
    - d. ANSI Z535.4, Product Safety Signs and Labels
  - 2. ASHRAE – American Society of Heating, Refrigeration, and Air Conditioning Engineers:
    - a. ASHRAE Standard 90.1, *Energy Standards for Buildings Except for Low Rise Residential Buildings* [ANSI, IESNA]
  - 3. ASTM – American Society for Testing and Materials
  - 4. CBM – Certified Ballast Manufacturers
  - 5. ICC – International Code Council
    - a. International Building Code® (IBC)
    - b. International Existing Building Code® (IEBC)
  - 6. ICEA – Insulated Cable Engineers Association
    - a. ICEA S-93-639, *Shielded Power Cables 5-46kV* (NEMA WC-74)
  - 7. IEEE® - Institute of Electronics and Electrical Engineers
    - a. IEEE C2™, *National Electrical Safety Code* (NESC) [ANSI]
    - b. IEEE Std 141™, *Recommended Practice for Electric Power Distribution for Industrial Plants* ("Red Book")
    - c. IEEE Std 143™, *Recommended Practice for Grounding of Industrial and Commercial Power Systems* ("Green Book")
    - d. IEEE Std 241™, *Recommended Practice for Electric Power Systems in Commercial Buildings* ("Gray Book")
    - e. IEEE Std 242™, *Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems* ("Buff Book")
    - f. IEEE Std 315™, *Graphic Symbols for Electrical and Electronics Diagrams*
    - g. IEEE Std 399™, *Recommended Practice for Power Systems Analysis* ("Brown Book")
    - h. IEEE Std 446™, *Recommended Practice for Emergency and Standby Power Systems for Industrial and Commercial Applications* ("Orange Book")

- i. IEE Std 493™, *Recommended Practice for the Design of Reliable Industrial and Commercial Power Systems* ("Gold Book")
- j. IEEE Std 519™, *Recommended Practices and Requirements for Harmonic Control in Electrical Power Systems*
- k. IEEE Std 739™, *Recommended Practice for Energy Management in Industrial and Commercial Facilities* ("Bronze Book")
- l. IEEE Std 902™, *Guide for Maintenance, Operation, and Safety of Industrial and Commercial Power Systems* ("Yellow Book")
- m. IEEE Std 1015™, *Recommended Practice Applying Low-Voltage Circuit Breakers Used in Industrial and Commercial Power Systems* ("Blue Book")
- n. IEEE Std 1100™, *Recommended Practice for Powering and Grounding Electronic Equipment* ("Emerald Book")
- o. IEEE Std 1584™, *Guide for Performing Arc-Flash Hazard Calculations*
- 8. IESNA – Illuminating Engineering Society of North America
  - a. IESNA *Lighting Handbook*, Ninth Edition
  - b. IESNA RP-1, *American National Standard Practice for Office Lighting*
  - c. IESNA RP-7, *American National Standard Practice for Lighting Industrial Facilities*
- 9. NECA – National Electrical Contractors Association:
  - a. NECA 1, *Good Workmanship in Electrical Construction* [ANSI]
  - b. NECA 90, *Recommended Practice for Commissioning Building Electrical Systems* [ANSI]
  - c. NECA 100, *Symbols for Electrical Construction Drawings* [ANSI]
  - d. NECA 101, *Standard for Installing Steel Conduits (Rigid, IMC, EMT)* [ANSI]
  - e. NECA 104, *Recommended Practice for Installing Aluminum Building Wire and Cable* [ANSI]
  - f. NECA / NEMA 105, *Recommended Practice for Installing Metal Cable Tray Systems* [ANSI]
  - g. NECA 111, *Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC)* [ANSI]
  - h. NECA / NACNA 120, *Standard for Installing Armored Cable (Type AC) and Metal-Clad Cable (Type MC)*[ANSI]
  - i. NECA 202, *Recommended Practice for Installing and Maintaining Industrial Heat Tracing Systems* [ANSI]
  - j. NECA 230, *Standard for Selecting, Installing and Maintaining Electric Motors and Motor Controllers* [ANSI]
  - k. NECA 331, *Standard for Building and Service Entrance Grounding and Bonding*
  - l. NECA 400, *Standard for Installing and Maintaining Switchboards* [ANSI]
  - m. NECA 402, *Standard for Installing and Maintaining Motor Control Centers* [ANSI]
  - n. NECA / EGSA 404, *Standard for Installing Generator Sets* [ANSI]
  - o. NECA 407, *Recommended Practice for Installing and Maintaining Panelboards* [ANSI]
  - p. NECA 408, *Recommended Practice for Installing and Maintaining Busways* [ANSI]
  - q. NECA 409, *Recommended Practice for Installing and Maintaining Dry-Type Transformers* [ANSI]
  - r. NECA 410, *Recommended Practice for Installing and Maintaining Liquid-Filled Transformers* [ANSI]
  - s. NECA 411, *Recommended Practice for Installing and Maintaining Uninterruptible Power Supplied (UPS)* (ANSI)
  - t. NECA 420, *Standard for Fuse Applications* [ANSI]
  - u. NECA 430, *Standard for Installing Medium-Voltage Metal-Clad Switchgear* [ANSI]
  - v. NECA / IESNA 500, *Recommended Practice for Installing Indoor Lighting Systems* [ANSI]
  - w. NECA / IESNA 501, *Recommended Practice for Installing Exterior Lighting Systems* [ANSI]
  - x. NECA / IESNA 502, *Recommended Practice for Installing Industrial Lighting Systems* [ANSI]
  - y. NECA / MACSCB 600, *Recommended Practice for Installing and Maintaining Medium-Voltage Cable* [ANSI]
  - z. NECA / NEMA 605, *Installing Underground Nonmetallic Utility Duct* [ANSI]

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10. NEMA – National Electrical Manufacturers Association
11. NETA – International Electrical Testing Association, Inc.:
  - a. NETA ATS, *Acceptance Testing Specifications for Electrical Power Distribution Equipment and Systems*
  - b. NETA MTS, *Maintenance Testing Specifications for Electrical Power Distribution Equipment and Systems*
  - c. NETA ETT, *Standard for Certification of Electrical Testing Technicians* [ANSI]
12. NFPA – National Fire Protection Association:
  - a. NFPA 20®, *Standard for the Installation of Stationary Pumps for Fire Protection*®
  - b. NFPA 70™, *National Electrical Code*® (NEC®)
  - c. NFPA 70E, *Standard for Electrical Safety in the Workplace*.
  - d. NFPA 101®, *Life Safety Code*®
  - e. NFPA 110, *Standard for Emergency and Standby Power Systems*
  - f. NFPA 111, *Standard on Stored Electrical Energy Emergency and Standby Power Systems*
  - g. NFPA 780, *Standard for the Installation of Lightning Protection Systems*
  - h. All other NFPA codes and standards except NFPA 5000
13. OSHA – Occupational Safety and Health Administration
14. IECC – International Energy Conservation Code
15. ISO – International Organization for Standardization
16. State and Local Energy Conservation Code
17. Applicable County and Municipal Codes

#### 1.5 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. Every effort has been made by the Engineer to indicate wiring of all receptacles, light fixtures, switches, telephone outlets, HVAC equipment, other equipment, elevator equipment, and all other devices / appliances requiring electrical power. It is the intent of the Engineer that all light fixtures be powered and controlled unless specifically noted on the plans; that all wiring devices (receptacles and direct connected equipment) be circuited to a power source of the correct voltage and that all HVAC, elevator equipment and other equipment be properly wired to the correct voltage power source; that all communications and security systems devices and equipment and all fire alarm system devices and equipment are installed, wired and systems are fully operational.
- C. It is the responsibility of the Contractor to review the construction drawings (reflected ceiling plans) for light fixtures, casework elevation details for electrical devices which are not indicated on the electrical drawings; to review the mechanical and plumbing documents and all other drawings to determine the electrical rough-ins for all equipment requiring power connections, and to include in their proposals the correct and complete electrical rough-ins for all of these items which were inadvertently not indicated on the electrical drawings, OR the Contractor shall specifically enumerate each item requiring electrical rough-in which is not specifically shown on the electrical drawings, and indicate the electrical provisions of these items as specifically excluded from his proposal.
- D. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.
- E. No proposal shall be accepted which specifically excludes any of the provisions of paragraphs B, C, or D above.

#### 1.6 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other

pertinent items, as installed. Record underground and under slab service and feeders installed, dimensioning exact location and elevation of such installations.

- B. At conclusion of project, obtain without cost to the Owner, electronic PDF and AutoCAD 2014 and / or Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducibles and prints is a condition of final acceptance.
  - 1. 3 sets of electronic AutoCAD (2014 dwg) and / or Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
  - 2. One reproducible Dayrex Mylar film positive of each contract as-built drawing.
  - 3. Three sets of blue-line prints of each contract as-built drawing.
  - 4. Three sets of pdf prints of each contract as-built drawing on CD.
- C. As-Built Drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's Seal, name, address, and logo from drawings.
  - 3. Mark documents RECORD DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY:
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all conduits, etc. that was deviated from construction drawings.
  - 6. Indicate exact location of all underground electrical raceways, and elevations.
  - 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 9. Exact location of all electrical equipment in building. Label panel schedules to indicate actual location.
  - 10. Exact location of all electrical equipment in and outside of the building.
  - 11. Exact location of all outdoor lighting poles and equipment.
  - 12. Location, size and routing of all feeder conduits, equipment, etc. shall be accurately and neatly shown to dimension.
  - 13. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 14. Cloud all changes.
  - 15. Update all panel schedules with all additional circuits added or deleted through construction. Identify each circuit to include all information specified for directory cards for circuit identification in panelboards.

#### 1.7 SPACE REQUIREMENTS

- A. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.8 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Provide sleeves and inserts in forms as required for the work. Stub up and protect open ends of pipe before any concrete is placed. Furnish sizes of required equipment pads. Furnish and locate bolts and fittings required to be cast in them.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for

#### ELECTRICAL GENERAL PROVISIONS

the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.

1. Make final electrical connections to all electrically operated equipment indicated on the drawings, except as noted.
2. The responsibility for alignment of motor and driven equipment is specified in the related division.

F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.

G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

#### 1.9 CONCEALED AND EXPOSED WORK

A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

#### 1.10 GUARANTEE

A. Guarantee work for 1 year from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. Replacement of failed parts or equipment shall be provided.

#### 1.11 MATERIAL AND EQUIPMENT

A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

#### 1.12 NOISE AND VIBRATION

A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work, and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

#### 1.13 ACCEPTABLE MANUFACTURERS

A. Manufacturers names and catalog number specified under sections of Division 26 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, materials, energy efficiency characteristics (where applicable) and lighting performance characteristics (where applicable) equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit a marked-up set of the relevant specification section indicating all variances, a comparison to the specified product, and of construction and performance criteria, complete design and performance data for the specified product and the proposed substitution for comparison to the Engineer. The Architect issues approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.

#### 1.14 UTILITIES, LOCATIONS AND ELEVATIONS

A. Locations and elevations of the various utilities included within the scope of this work:

1. Obtained from utility maps and other substantially reliable sources.
2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.

- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

#### 1.15 OPERATING TESTS

- A. After all electrical systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

#### 1.16 WARRANTIES

- A. All normal and extended warranties shall include parts, labor, miscellaneous materials, travel time, incidental expenses, normal freight / shipping, refrigerant, oils, lubricants, belts, filters and any expenses related to service calls required to diagnose and correct warranty problems.
- B. Manufacturer's warranty shall be from one year from date of substantial completion. Contractor shall be responsible for extending the warranties regardless of date of installation or commissioning.
- C. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

#### 1.17 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Contract Drawings, details and specifications and thoroughly familiarize himself as to the construction and all job related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager Job site superintendent and lay out work so that all raceways and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

#### 1.18 TEMPORARY FACILITIES

- A. General: Refer to Division 1 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under this Division. Installation of temporary power shall be in accordance with NEC Article 527.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed by this Contractor at the completion of the Contract.

### PART 2 - PRODUCTS – NOT USED

### PART 3 - EXECUTION

#### 3.1 IDENTIFICATION OF EQUIPMENT

- A. Identification of Equipment:
  - 1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions. All panels, cabinets, or equipment requiring 120 volt or higher power shall be labeled as required which includes circuit designation and circuit panelboard location, regardless of which discipline installs the equipment.
  - 2. Three layer laminated plastic engraved identifying nameplate shall be permanently secured to each switchboard, distribution panel, motor control center, transformer, panelboard, safety disconnect switch, enclosed circuit breaker, transfer switches, remote

generator transfer deices not installed inside light fixtures, wireway, busduct plug, terminal cabinet, surge protective device, capacitor, individual motor controller, contactor, fire alarm panels (main and remote booster), and communications (voice, data, video) cabinet or rack, security panels, time clocks, BMCS cabinets, sound reinforcement cabinets and racks, miscellaneous control cabinets, equipment integral disconnect switches, toggle or motor switches, disconnects for equipment, exterior junction boxes, exterior pull boxes, exterior wireways and gutters, and rooftop equipment (i.e.: supply and exhaust fans, rooftop HVAC equipment) with stainless steel screws.

- a. Utility Power: White letters on black background  
Generator Power (White letters on red background)  
UPS Power: White letters on blue background  
Load Bank Circuits: White letters on green background  
Solar or Wind Power Generation: White on orange background
- b. Identifying nameplates shall have 1/2-inch high, engraved letters for equipment designation and 1/4-inch letters indicating source circuit designation, (i.e.: "PANEL HA –fed from MDP-6 located in Mech. Rm. 100"). The words "fed from" and "located" shall be included in the labeling.
- c. Each switchboard, distribution panel, transfer switch, generator transfer device (GTD) for emergency lighting, and motor control center feeder or branch circuit device shall have a nameplate showing the load and location of load served in 1/4-inch high, engraved letters. Circuit breaker name and kirk key designation if applicable
- d. Each section of multiple section panelboards shall also indicate panelboard section number (i.e.: Panel "HA-Section 2 – fed from MDP-6 located in Mech. Rm. 100")
- e. Motor Controllers, starters, and contactors: Provide neatly typed label inside each motor controller and contactor enclosure door identifying motor or load served, nameplate horsepower, full load amperes, code letter, service factor, and voltage / phase rating.
- f. Individual motor controller and contactor nameplates shall include load served, location of load served, panel and circuit numbers serving load, location of panel serving load, panel and circuit number serving control circuit, location of panel serving control circuit (if different from panel serving load), description and location (if applicable) of control controlling contactor (i.e. Controlled: Switch in RM 100, and Controlled: BMCS). Contactor nameplate is to include whether it is a lighting or receptacle contactor and name of contactor. i.e. C-1.

Lighting Contactor Example	Receptacle Contactor Example
Lighting Contactor C1	Receptacle Contactor C2
West Parking Lot Pole Lights	Table Recpts Lab Rm 100
Fed From Panel HA-2,4,6	Fed From Panel LA-2,4,6,8
Located Main Elec. Rm. 100	Located Mech. Rm. 110
Control Circuit-Panel LA 42	Control Circuit-Panel LA-42
Located Main Elec. Rm. 100	Controlled-Emer Shut Off Mushroom
Controlled-BMCS	Switch Rm 101

- g. Exterior J-boxes, pull boxes, and gutters shall have panel identification, circuit numbers, and location of panel listed on name plate. Low voltage shall be identified per contents, examples: DATA, BMCS, F/A
- h. Name plates on equipment served from switchboards, distribution panels, I-Line panels, and motor control centers are not to include circuit numbers shown on drawings as the circuit numbers are for construction drawing purposes only.
- i. Panel names for 277/480v shall start with the letter "H" and 120/208v, 120/240v shall start with the letter "L". No panel shall be named to include a number other than multi sectional panels, example HA-section 2. New panels installed in renovation or site additions shall have names approved or designated by Owner's electrical representative. Panel names shall not include the letter "I". Transformer names shall start with the letter "T" followed by the panel name it serves, i.e. TLA.
- j. Main service ATS label shall include equipment name, emergency source and location, normal power source and location, panel served and location. Wall mounted ATS serving lighting loads shall include type of lighting and location, emergency panel and circuit ID and location of panel, normal panel and circuit ID and location of panel.

Main Service ATS Example

Wall Mounted Lighting ATS Example

#### ELECTRICAL GENERAL PROVISIONS

26 05 00-8



- |  | ATS-1                     | ATS                               |
|--|---------------------------|-----------------------------------|
|  | Emer Power-Emer Generator | Exterior Wall Packs/Soffit Lights |
|  | Located Chiller Yard      | North/West Metal Canopy Lights    |
|  | Normal Power-MSB          | Fed from EHA-2                    |
|  | Located-Mech Rm 100       | Located Mech Rm 200               |
|  | Serves Panel EHA          | Fed From HB-4                     |
|  | Located-Mech Rm 100       | Located Mech Rm 150               |
- k. Name plates shall include rated bus amperage, voltage, number of phases, number of wires and type of essential electrical system as applicable.
- l. Service equipment available fault current labeling: Provide a 2x3 inch label with blue lettering on contrasting background permanently affixed to the service disconnect/equipment prior to energizing the service equipment. The label shall include the date of installation and the date of calculation. The date of calculation shall be the date indicated by the Engineer of Record's Seal on the Construction Document Electrical One-Line Diagram / Riser Drawing. Example:

SERVICE EQUIPMENT AVAILABLE FAULT CURRENT: ##, ### AMPS  
DATE OF INSTALLATION: MM/DD/YY  
DATE OF CALCULATION: MM/DD/YY

3. Cardholders and directory cards shall be furnished for circuit identification in panelboards. Cardholder shall be located on inside of panel door and shall be in a metal frame with clear plastic front. Circuit lists shall be typewritten. Circuit descriptions shall include explicit description and identification of items controlled by each individual breaker, including final graphics room number or name designation and name of each item served. If no building appointed room number or name is given, list locations per the following examples – A. Storage in Rm 100 – B. Office in Rm 100 – C. Storage west of Rm. 100. List corridors as "corridors". Identify circuits controlled by contactors using a separate notation for each contactor used. List notation at bottom of schedule stating the circuits are controlled by a contactor, list exact location of contactor, and how switched. Do not use architectural room number designation shown on plans. Obtain final graphics room number identification from Architect's final room number graphics plan. All locations served by breakers shall be listed on schedule. Panel schedule shall be large enough to contain all information required. Also refer to Section 26 24 16.
4. Permanent, waterproof, black markers shall be used to identify each lighting and power grid junction box, gutter and wireway. Clearly indicate the panel and branch circuit numbers available at that junction box, gutter or wireway. Where low voltage relay panels are used for lighting control, identify the low voltage relay panel and number in addition to the branch circuit panel and number.
5. Pull Boxes, Transformers, Disconnect Switches, etc.: Field work each with a name plate showing identity, voltage and phase and identifying equipment connected to it. The transformer rating shall be shown on the panels or enclosures. For an enclosure containing a motor starter, the nameplate shall include the Owner's motor number, motor voltage, number of motor phases, motor load being serviced, motor horsepower, and motor full load current. Nameplates shall also indicate where panel is fed from.
- B. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- C. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of electrical facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- D. Wire and Cable Markers: Provide vinyl cloth markers with split sleeve or tubing type, except in manholes provide stainless steel with plastic ties.
- E. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways, contactors, and motor controllers and load connection. Identify with panelboard /

switchboard branch circuit or feeder number for power and lighting circuits, and with control wire number as indicated on equipment manufacturer's shop drawings for control wiring.

- F. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red for 50 volts or above electrical, or orange for communications and control with suitable warning legend describing buried electrical lines; telephone lines and data lines per APWA recommendations. All underground electrical conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground electrical conduits.
- G. Lighting Controls and Equipment: Provide self-adhesive machine typed tape labels with ¼" high white letters on ½" tall black background for digital lighting modules as "DLM". Modules or relays located above ceiling: adhere label to bottom of ceiling T-grid below relay location. Modules or relays located in mechanical or electrical rooms or other areas other than above ceiling: Adhere label to the cover of the module or relay and identify the area they control as "MAIN GYM", "BAND HALL", or "CORRIDOR 100", etc. Remote lighting control switches or push button stations located remotely from the area they control: Adhere label to device face plate, not obstructing screw fasteners, and intuitively identify function such as "GYM LTG LOW-HIGH" or "CAFE LTG DIM", etc.

### 3.2 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 1 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

### 3.3 INSTRUCTION OF OWNER'S PERSONNEL

- A. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the electrical systems.
  - 1. Provide the training during regular working day.
  - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
  - 3. Refer to other specification sections for additional training and commissioning requirements.
- B. Time to be allocated for instructions.
  - 1. Minimum of 5 hours dedicated instructor time
  - 2. 1 hours on each of 5 days
  - 3. Additional instruction time for specific systems as specified in other Sections.
- C. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
  - 1. One copy to the Owner
  - 2. One copy to the Architect / Engineer
- D. The Owner shall provide a list of personnel to receive instructions, and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, trouble-shooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.

- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he / she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

3.4 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

3.5 HOUSEKEEPING PADS

- A. Provide concrete equipment housekeeping pads under all floor and outdoor mounted electrical equipment.
- B. Concrete and reinforcing steel shall be as specified in Division 3, or as indicated or noted.
- C. Concrete pads:
  - 1. 6-inches thick minimum indoors; 8-inches thick minimum outdoors, or match existing if indicated on the drawings to extend existing pads, or in other sections of the specifications.
  - 2. Chamfer strips at edges and corner of forms.
  - 3. Smooth steel trowel finish.
  - 4. Extend 3-inches minimum indoors beyond perimeter of equipment unless otherwise shown.
  - 5. 6-inch x 6-inch #8 wire reinforcement mesh.

3.6 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information has been provided.
  - 2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.7 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used, and 25 percent spare fasteners.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.8 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment

ELECTRICAL GENERAL PROVISIONS

from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

### 3.9 COORDINATION OF BRANCH CIRCUIT OVERCURRENT AND PROTECTION DEVICES

- A. Review with equipment specified which requires electrical connections. Review equipment shop drawings and manufacturer's nameplate data and coordinate exact branch circuit overcurrent protective device and conductors with equipment provided.
1. Provide equipment manufacturer's recommended overcurrent protective device indicated on nameplate at no additional cost to the Owner.
  2. If branch circuit conductors and / or conduit sizing is less than the minimum required by equipment manufacturer, notify the Architect / Engineer immediately, prior to rough-in.
  3. If equipment manufacturer is a substitution to the specified equipment manufacturer, provide the greater of the conductors specified or those required for the installed equipment manufacturer's minimum circuit conductors, at no additional cost to the Owner.
  4. If conductors indicated on plans are in excess of that permitted by equipment manufacturer, notify Architect / Engineer immediately, prior to rough-in.
  5. If conductors indicated on plans are in excess of that permitted by the equipment manufacturer, provide the maximum conductors permitted by the equipment manufacturer based on NEC ampacity tables, either in a single set, or as a set of parallel conductors as permitted by the NEC. Conductor size and quantity entering the equipment enclosures shall not exceed the equipment manufacturer's maximum recommendations.

### 3.10 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each new telephone equipment terminal location.
  2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each new data / voice / video / communications equipment location / cable TV head end equipment, or security equipment location.

### 3.11 TESTING

- A. The contractors for the various sub-systems shall submit proposed testing procedures for their systems, subject to review and approval and Owner acceptance. The contract will not be declared to be substantially complete until the functional operation of the subsystems have been demonstrated and verified and reports have been provided, reviewed and accepted.
- B. The project will not be declared substantially complete until the following has taken place.
1. The "As-Built" drawings have been submitted, reviewed and accepted by the Architect / Owner / Owner's Construction Representative.
  2. The building emergency lighting system and other systems including but not limited to those listed below have been tested, completed factory start-up and programming and adjusting as required for a complete and fully operational system acceptable to the Architect and Owner.
    - a. Occupancy Sensor and Lighting Controls
    - b. Surge protective device equipment
    - c. Overcurrent devices
    - d. Motor Controllers
    - e. Emergency Lighting
    - f. Building Fire Alarm System
    - g. Clock System
    - h. Television Distribution System
    - i. Building Data / Voice Cabling System
    - j. Surveillance and Security System
    - k. Intercom / Telephone
    - l. Sound Reinforcement Systems
    - m. Building Lightning protection System

3.12 LOAD BALANCING

- A. Balance the loads on each low-voltage feeder so that the voltage on each phase is within +/- 1.0% of the average voltage of the three phases. Refer to the DOE Office of Industrial Technologies, "Motor Tip Sheet #7" dated September 2005 available for download to PDF format at no charge at: [http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate\\_voltage\\_un\\_balanced\\_motor-systems7.pdf](http://www1.eere.energy.gov/industry/bestpractices/pdfs/eliminate_voltage_un_balanced_motor-systems7.pdf)

END OF SECTION

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SECTION 26 05 05

ELECTRICAL ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There is the possibility that there exist conditions and devices that are affected by the work indicated on the drawings and called for in the specifications (project manual) that do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to consider these existing conditions when making and presenting a proposal, to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect / Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect / Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.
- D. Verify that abandoned wiring, panelboards, and switchboards, disconnect switches, and equipment serve only abandoned facilities. Where abandoned wiring, panelboards, switchboards, and equipment which serve existing facilities are to remain, Contractor shall provide means and methods to ensure existing facilities remain energized with the correct voltage, overcurrent protection, conductors, and circuit ampacity required by the existing facilities to remain.
- E. Demolition Drawings are based on casual field observation, and when available, existing record documents. Report discrepancies to Architect before disturbing existing installation, and immediately after such discrepancies are discovered.

ELECTRICAL ALTERATIONS PROJECT PROCEDURES

### 3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to installation and reuse in the modified system.
- B. Remove existing luminaries for alterations/renovations. Use mild detergent to clean all exterior and interior surfaces; rinse with clean water and wipe dry. For each luminaire that is taken down for alteration and then reinstalled, replace damaged parts, provide new lamps and, with matching paint, touch-up scratched or abraded areas, and replace cracked, broken or missing lenses or diffusers. Replace unrepairable fixtures with new fixtures
- C. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- D. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- E. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- F. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- G. Clean and repair existing materials and equipment that remain or are to be reused.
- H. Panelboards Reused and Modified for Renovation: 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.

### 3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Utility Company, Architect and Owner.
- B. 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.
- C. Existing Electrical Service: Refer to drawings for work in remodeled areas. Where facilities in these areas are to remain in service, any related work to keep the facilities in operation is specified in this Division. Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Obtain written permission from Owner at least 10 business days before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area. Disclose the extent, exact time and expected duration of the outage in a written request to the Owner.
- D. Remove and replace existing conduit, wiring, outlets, devices, lighting fixtures, panels and appurtenances as occasioned by new or remodeled construction. Re-establish service to lights, switches and devices that may be interrupted by remodeled construction.
- E. Disconnect electrical systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
  - 1. Remove exposed conduit that has been abandoned.
  - 2. Cap conduit beyond the finish line.
  - 3. Provide unswitched circuit leg for emergency battery powered equipment; circuit from same branch circuit breaker as switched normal lighting circuit.
- F. Where new/existing luminaries or devices are shown being connected to existing circuits:
  - 1. Field verify existing system voltage
  - 2. Provide ballast / device to match system voltage
- G. Verify the loading of each circuit affected by remodeling work. The maximum load of any branch



circuit shall not exceed 80% of its rating.

- H. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect / Owner for salvage by Owner. Remove abandoned / not required raceways and wiring back to nearest box serving load to remain, or back to panel if not serving remaining load.
- I. Existing Power, and Lighting and Appliance Branch Circuit Distribution System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- J. Existing Lighting System: Maintain existing system in service unless as noted or specified otherwise. Disable system only to make switchovers and connections. Notify Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- K. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- L. Existing Telephone System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and Telephone Company at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- M. Existing Paging and Sound Reinforcement Systems: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- N. Existing Data Network: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- O. Existing Video Distribution System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- P. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.
- Q. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 72 hours before partially or completely disabling system. Minimize outage duration. Make connections to maintain service in areas adjacent to work area.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of

the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

1. Remove abandoned electrical distribution equipment, utilization equipment, outlets and accessible portions of wiring, raceway systems, and cables back to the source panelboard, switchboard, switchgear, communications closet, or cabinet. Abandoned wiring and raceways can result from actions that include the following:
    - a. Equipment is removed or relocated
    - b. Fixtures are removed or relocated
    - c. System is no longer used
    - d. There is no demonstrable near term future use for the existing circuit or raceway system.
  2. Leave abandoned electrical equipment, conductors, and material in place only if one or more of the following conditions exist:
    - a. The removal requires the demolition of other structures, finishes, or equipment that is still in use. An example is abandoned conduit above an existing plaster ceiling.
    - b. Removal is not feasible due to hazards, construction methods, or restricted access.
    - c. Removal of abandoned conductors may damage conductors that must remain operational.
  3. Remove conduits, including those above accessible ceilings, to the point that building construction, earth, or paving covers them. Cut conduit beneath or flush with building construction or paving. Plug, cap, or seal the remaining unused conduits. Install blank covers for abandoned boxes and enclosures not removed.
  4. Extend existing equipment connections using material and methods compatible with the existing electrical installation and this division.
  5. Restore the original fire rating of floors, walls, and ceilings after electrical demolition.
  6. Use approved lock-out / tag-out procedures to control hazardous energy sources. Assure that an electrically safe work condition exists in the demolition area before beginning demolition. Where possible, disconnect the building from all sources of electrical power before beginning demolition.
- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. 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. Replace existing wiring devices and cover plates with new wiring devices and new cover plates in renovated areas. Any corridor, room, or area indicated to have any new wiring devices installed shall have all of the existing wiring devices and cover plates replaced with new wiring devices and new cover plates.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

- G. Disconnect and remove abandoned luminaries. 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.
- K. Existing conduit raceway found to need additional hangers installed and/or junction box covers shall be added at no additional cost to the Owner.
- L. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.

3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.

3.6 IDENTIFICATION OF EQUIPMENT IN RENOVATED AREAS

- A. Identification of Equipment: Provide new, typed panel directory cards (and card holders if needed) for existing panelboards located within the renovated areas. Ring out all new and existing circuits within these panelboards as specified in Section 26 05 00 Electrical General Provisions. Do not include the description "existing". Provide new nameplates for all existing electrical equipment in renovated areas as specified in Section 26 05 00 Electrical General Provisions.

3.7 CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Repairs, equipment replacements, and corrections to low voltage systems due to damage caused by contractor:
  - 1. Notify the Owner immediately of any disruption or damage to any low voltage system.
  - 2. Any disruption or damage to the existing access control system or fire alarm system shall be corrected the same day as the disruption or damage occurred. The access control system and fire alarm system shall be tested daily in the presence of the owner prior to the Contractor leaving the job site each day.
  - 3. For each low voltage system other than access control or fire alarm system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
  - 4. Corrective measures to all low voltage systems to correct components of the low voltage systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect / Engineer prior to acceptance of substantial completion at no additional cost to the Owner.

END OF SECTION

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SECTION 26 05 10

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents. Submit a narrative outline of the Quality Control Program or Plan.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality. Persons performing electrical work shall be required to be licensed. There shall be on-site supervision at all times, including punch list work, with that person having a minimum of journeyman license. Helpers, apprentices shall have a minimum of apprentice license.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes matching approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide manufacturer's qualified personnel to observe:
  - 1. Field conditions
  - 2. Condition of installation
  - 3. Quality of workmanship
  - 4. Start-up of equipment
  - 5. Testing, adjusting, and balancing of equipment
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.

CONTRACT QUALITY CONTROL

- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.
- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

#### 1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
  - 1. Rough-in
  - 2. Finish with all appurtenances in place
  - 3. Demonstrations
- B. Refer to other specification sections for pre-functional checklist for requirements to aid in preparing mock-ups.

### PART 2 - PRODUCTS

#### 2.1 EQUIPMENT AND MATERIAL

- A. Comply with recognized National rating and approval agencies as well as all codes and ordinances at the federal, state and city levels.

### PART 3 - EXECUTION

#### 3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.
- B. Coordination Drawings:
  - 1. Electrical room size and location required and to scale
  - 2. Equipment and accessories, switchgear and piping
  - 3. Indicate clearances and service access.

#### 3.2 ELECTRICAL ACCEPTANCE TESTING

- A. Perform electrical acceptance testing and inspections in accordance with the current edition of the International Electrical Testing Association (NETA), *Acceptance Testing Specification (ATS)*.
- B. Perform acceptance testing, inspection, function tests, and calibration to assure that installed electrical systems and components, both Contractor and user-supplied are:
  - 1. Installed in accordance with design documents and manufacturer's instructions.
  - 2. Tested and inspected in accordance with applicable codes and standards (e.g. NFPA 110 and NFPA 111).
  - 3. Ready to be energized.
  - 4. Operational within industry and manufacturer's tolerances.

#### 3.3 INSPECTIONS BY LOCAL AUTHORITY HAVING JURISDICTION (AHJ)

- A. Contractor shall notify design prime consultant and associated Architect / Owner's Construction Manager when he requests an inspection by the AHJ.

#### 3.4 MOCK-UPS

- A. Mock up the light fixture fireproofing for each type of light fixture to be located in fire rated ceilings. Demonstrate that the fire proofing material does not interfere with the mechanical operation of light fixture doors, hinges, or latches.

END OF SECTION

SECTION 26 05 12

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- D. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
  - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

1.3 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 1.

PART 2 - PRODUCTS - NOT USED

PART 3 - EXECUTION

3.1 SPECIFICATION COMPLIANCE REVIEW

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c)

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.

### 3.2 COMPOSITE COORDINATION DRAWINGS

- A. Produce a set of composite coordinate drawings for review and comment within four (4) weeks of receipt of Owner's official Notice to Proceed. Show coordination of structural and architectural elements with HVAC piping, ductwork, mechanical equipment, electrical conduit, low voltage systems cabling, lighting, electrical switchgear and panels, security and CCTV systems, domestic water piping, roof drains and storm sewer piping, sanitary sewer piping and fire sprinkler piping and a composite above-ceiling plan, below slab coordination drawings, and a composite mechanical and electrical equipment room floor plan.
  - 1. Prepare the composite plans at one-quarter inch (1/4") equals one-foot scale. Include larger scale sections with vertical elevations of elements as required to confirm coordinate of all elements.
  - 2. For each room containing major electrical switchgear and each outside equipment area with major electrical switchgear and other equipment also include NEC working space, NEC equipment space, and NEC access to NEC working space, and housekeeping pad location and dimensions.
  - 3. Prepare coordination drawings to coordinate installations for efficient use of available space allowing for future additional equipment wherever possible, for proper sequence of installation, and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
  - 4. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- B. Submit composite coordination shop drawings in plan, elevation and sections, showing receptacles, outlets, electrical and telecommunication devices in casework, cabinetwork and built-in furniture.
  - 1. Verify location of wiring devices and outlets, communication devices and outlets, safety and security devices, and other work specified in this Division.
  - 2. Coordinate with drawing details, site conditions, composite coordination drawings, and millwork other equipment shop drawings prior to installation.
  - 3. Submit coordination and shop drawings prior to rough-in and fabrication.

### 3.3 EQUIPMENT SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submittal Specification Information:
  - 1. Every submittal document shall bear the following information as used in the project manual:
    - a. The related specification section number
    - b. The exact specification section title
  - 2. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.
- C. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- D. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- E. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- F. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- G. Submit drawings in a clear and thorough manner. Identify details by reference to sheet and detail,

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA



schedule, or room numbers shown on Contract Drawings.

- H. Show all dimensions of each item of equipment in its to be installed assembled condition with all components assembled. Include a series of drawings of individual components as necessary for reference.
- I. Identify field dimensions; show relation to adjacent or critical features or work or products.
- J. Submit individually bound shop drawings and product data for the following when specified or provided. The Fault Current and Overcurrent Device Coordination Analysis shall be submitted prior to other switchgear.
  - 1. Fault Current and Overcurrent Device Coordination Analysis. Submit this analysis three (3) weeks prior to any overcurrent device submittal to allow modifications to overcurrent device product selection submittal based on the manufacture's analysis and recommendations at no additional cost to the Owner.
  - 2. Enclosed Switches and Circuit Breakers
  - 3. Enclosed Motor Controllers
  - 4. Panelboards, load centers, and enclosures
  - 5. Wiring devices
  - 6. Lighting fixtures
  - 7. Lighting Controls and Occupancy Sensors
  - 8. Surge Protection Devices
  - 9. Site Lighting Poles, Fixtures, Drivers, and Lamps
  - 10. Electrical controls and time switches
  - 11. Electrical Contactors
  - 12. Motor control centers
  - 13. Transformers
  - 14. Switchboards
  - 15. RTRC and/or PVC coated galvanized steel conduit and fittings conduit and fittings
  - 16. Surface Raceways
  - 17. Architectural Dimming Systems
  - 18. Theatrical Lighting Systems
  - 19. Fire Rated Cables and Connectors
  - 20. Medium Voltage Cable and Connectors

### 3.4 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up, adjusting, calibrating, balancing and finishing.

### 3.5 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.

### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations identified by the Contractor on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed by the Contractor for processing or for making corrections for re-submittal.
- J. Contractor's Stamp of Approval
  - 1. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
  - 2. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.
  - 3. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
  - 4. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

### 3.6 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor. Product and equipment related to site work or other trades which require extensive rough-in, foundations, or structural support shall be submitted as soon as possible after given notice to proceed with construction.
- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit one electronic data file (pdf) and three opaque reproductions.
  - 2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer, and/or electronic data (pdf) files.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and telephone number
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
- 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items requiring correlation for efficient function or for installation

3.7 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals. Re-submittals shall be a complete submittal as if it were the initial submittal unless otherwise instructed in the review comments on the original submittal.
- 1. Indicate that the document or sample is a resubmittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

END OF SECTION

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SECTION 26 05 19

CONDUCTORS AND CONNECTORS – 600 VOLT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical conductors, wire and connector work as shown, and specified.
- B. Types: The types of conductors and connectors required for the project include the following:
  - 1. 600V building conductors
  - 2. 600V building conductor connectors
- C. Application: The applications for conductors and connectors required on the project are as follows:
  - 1. Power distribution circuitry
  - 2. Lighting branch circuitry
  - 3. Appliance, receptacle, and equipment branch circuitry
  - 4. Motor branch circuitry
  - 5. Control wiring
  - 6. Line voltage
- D. Refer to other specific specification sections for voice, video, data, alarm and instrumentation cables.

1.2 QUALITY ASSURANCE

- A. UL Label: Conductors and connectors shall be UL labeled.

1.3 REFERENCES

- A. Refer to other specific specification sections regarding specialized wiring and connections.

PART 2 – PRODUCTS – Provide products manufactured in the USA

2.1 CONDUCTORS AND CONNECTORS

- A. General: Except as indicated, provide conductors and connectors of manufacturer's standard materials, as indicated by published product information, designed and constructed as instructed by the manufacturer, and as required for the installation.
- B. Cable Lubricant: Fire resistant, nonflammable, water-based type for standard building conductors. Provide cable lubricants for fire rated cables as recommended by the cable manufacturer.
- C. Conductors: Provide factory-fabricated conductors of the size, rating, material, and type as indicated for each use. Conductors shall be soft or annealed copper wires meeting, before stranding, the requirements of ASTM B 3, Standard Specification for Soft or Annealed Copper Wire for Electrical Purposes, latest edition.
  - 1. Conductors for control wiring sized #14 AWG through #10 AWG shall be stranded.
  - 2. Conductors for power and lighting shall be stranded. Stranding shall be Class B meeting the requirements of ASTM B 8, Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium Hard, or Soft.
- D. Insulation for standard building conductors: Insulation shall meet or exceed the requirements of UL 83, Standard for Thermoplastic Insulated Wires.
  - 1. All wiring inside lighting fixtures shall be temperature rated per NEC.
  - 2. Insulation for copper conductors shall be UL Type THHN/THWN, 90 degrees C.

2.2 COLOR CODES FOR CONDUCTORS FOR BRANCH CIRCUITS AND FEEDERS

- A. Color coding for conductors as required by NEC 210.5. Color coding for phase and voltage shall be as required by local codes and local standards. Where such standards do not exist, color coding shall be as follows:

CONDUCTORS AND CONNECTORS

Color Code Table	USE CONTINUOUS COLOR CODED INSULATION THROUGHOUT					
System/Phase	A	B	C	N	G	IG
120/208 3 Ph	Black	Red	Blue	White	Green	Green/Yellow Stripe
120/240 3 Ph	Black	Orange	Blue	White	Green	Green/Yellow Stripe
120/240 1 Ph	Black	N/A	Blue			
277/480	Brown	Purple	Yellow	Gray	Green	Green/Yellow Stripe

Notes to Color Code Table:

1. 120/208, 120/240, and 277/480 Volt Systems shall be routed in separate raceways.
2. Switched legs of phase conductors for lighting and appliance branch circuits shall be of the same color as described above throughout the entire circuit.
3. Conductors shall be the same color from breaker to device or outlet.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install electrical conductors and connectors as shown, in accordance with the manufacturer's written instructions, the requirements of NEC, the NECA Standard of Installation, and industry practices.
- B. Coordination: Coordinate conductor installation work with electrical raceway and equipment installation work, as necessary for interface.
- C. Conductors:
  1. Provide a grounded (neutral) conductor for each branch circuit. Do not share grounded (neutral) conductors.
  2. No more than six phase conductors shall be installed in a single raceway. Any combination of phase conductors and grounded (neutral) conductors in any raceway shall not exceed nine.
  3. When any combination of four or more phase and grounded (neutral) conductors are installed in a raceway, the minimum size for all conductors including equipment ground conductor shall be #10 AWG, and they shall be de-rated accordingly.
  4. When more than four (4) conductors are size #10 AWG, they shall be installed in a one-inch conduit.
  5. Pull conductors together when more than one is being installed in a raceway. Whenever possible, pull conductors into their respective conduits by hand. Use pulling lubricant when necessary.
  6. Before any conductor is pulled into any conduit, thoroughly swab the conduit to remove foreign material and to permit the wire to be pulled into a clean, dry conduit.
  7. Run feeders their entire length in continuous section without joints or splices.
  8. No wire smaller than #12 AWG shall be permitted for any lighting or power circuit. No wire smaller than #14 AWG shall be used for any control circuit, unless shown otherwise.
  9. Provide the same size wire from the panelboard to last outlet on circuit. For 20 amp branch circuits operating at 150V or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating at 150 to 600 volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
  10. Branch circuit voltage drop shall not exceed 3% of rated voltage.
    - a. Total voltage drop from the point of service to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
    - b. Total voltage drop from the point of service to transformers with adjustable taps, buck-boost transformers, uninterruptable power supplies (UPS), or voltage regulators shall not exceed five-percent of rated voltage.

## CONDUCTORS AND CONNECTORS

- c. Total voltage drop from a separately derived system, transformer with adjustable taps, buck-boost transformer, uninterruptable power supply (UPS), or voltage regulator to the last outlet or utilization equipment of the same voltage shall not exceed five-percent of rated voltage.
  - d. Total voltage drop from the point of service to distribution equipment of the same voltage shall not exceed two-percent of rated voltage.
  - e. Branch circuit voltage drop from distribution equipment to the last outlet or utilization equipment shall not exceed three-percent of rated voltage.
  - f. Provide the same size branch circuit conductors to last outlet on circuit unless specifically noted or indicated otherwise on the drawings. For 20 amp branch circuits operating at 150-Volts or less, provide #10 AWG wire when the first outlet is over 75-feet from the panelboard. For branch circuits operating above 150-Volts to 600-Volts, provide #10 AWG wire when the first outlet is over 150-feet from the panelboard.
- 11. No tap or splice shall be made in any conductor except in outlet boxes, pull boxes, junction boxes, splice boxes, or other accessible locations. Make taps and splices using an approved compression connector. Insulate taps and splices equal to the adjoining conductor. Make splices or taps only on conductors that are a component part of a single circuit, protected by approved methods. Taps or splices in feed through branch circuits for connection to light switches or receptacles shall be made by pigtail connection to the device.
  - 12. Support conductors in vertical raceways, as required by the NEC.
  - 13. Do not permit conductors entering or leaving a junction or pull box to deflect to create pressure on the conductor insulation.
  - 14. Make joints in branch circuits only where circuits divide. These shall consist of one through circuit to which the branch from the circuit shall be spliced.
  - 15. Make connections in conductors up to a maximum of one #6 AWG wire with two #8 AWG wires using twist-on pressure connectors of required size.
  - 16. Make connections in conductors or combinations of conductors larger than specified using cable fittings of type and size required for specific duty.
  - 17. After a splice is made, insulate entire assembly with UL-approved insulating tape to a value equivalent to the adjacent insulation.
  - 18. Make splices and connections in control circuit conductors using UL-approved solderless crimp connectors.
  - 19. All conduits shall be installed with an insulated grounding conductor per NEC 250.122. Where green conductor insulation is not available, the ground conductor shall be identified with green phasing tape at all accessible locations.
  - 20. Neatly train and lace wiring inside boxes, equipment and panelboards. Provide tie-straps around conductors with their shared neutral conductor where there are more than two neutral conductors in a conduit.
  - 21. Clean conductor surfaces before installing lugs and connectors.
  - 22. Make splices, taps and terminations to carry full ampacity of conductors with no perceptible temperature rise.
  - 23. Provide stranded conductors connected with pressure type connectors / compression fittings and terminal lugs UL listed for the type of conductor used (AL-CU) and correctly sized to the diameter of the bare conductors.
  - 24. Run mains and feeders their entire length in continuous pieces without splices or joints.
  - 25. Color code conductors.
  - 26. Do not install a pull string in conduits containing conductors.
  - 27. Conductors shall be the same color from load side of overcurrent protection device to outlet or utilization equipment.
  - 28. Spare conductors shall not be installed in any conduit, gutter, raceway, panel or enclosure unless noted otherwise.
- D. Identification: Label each phase conductor in each junction box with corresponding circuit number, using self-adhesive wire markers.
- E. Splices and Joints:
- 1. In accordance with UL 486A, C, D, E, and NEC.
  - 2. Aboveground Circuits (No. 10 AWG and smaller):
    - a. Connectors: Solderless, screw-on, reusable pressure cable type, rated 600 V, 220° F, with integral insulation, approved for copper and aluminum conductors.

CONDUCTORS AND CONNECTORS

- b. The integral insulator shall have a skirt to completely cover the stripped wires.
    - c. The number, size, and combination of conductors, as listed on the manufacturers' packaging, shall be strictly followed.
  - 3. Motor connections:
    - a. All AHU motors connections shall be split bolt connectors.
    - b. All non-AHU motors 10 HP and larger shall be split bolt connectors.
    - c. All non-AHU motors less than 10 HP shall be split bolt connectors or as recommended by the manufacturer.
- F. Aboveground Circuits (No. 8 AWG and larger):
  - 1. Connectors shall be indent, hex screw, or bolt clamp type of high conductivity and corrosion resistant material, listed for use with copper and aluminum conductors.
  - 2. Provide field-installed compression connectors for cable sizes 250 kcmil and larger with not less than two clamping elements or compression indents per wire.
  - 3. Insulate splices and joints with materials approved for the particular use, location, voltage, and temperature. Splice and joint insulation level shall be not less than the insulation level of the conductors being joined.
  - 4. Plastic electrical insulating tape: Per ASTM D2304, flame-retardant, cold and weather resistant.
- G. Underground Branch Circuits and Feeders:
  - 1. Submersible connectors in accordance with UL 486D, rated 600 V, 190°F, with integral insulation.

### 3.2 TESTING

- A. Pre-Energization Check: Before energizing, check cable and conductors for circuit continuity and short circuits. Correct malfunctions.
- B. Service Entrance and Feeder Insulation Resistance Test: Each main service entrance conductor and each feeder conductor shall have its insulation resistance tested after the installation is complete except for connection at its source and point of termination. Testing shall be performed by qualified technicians who have been trained in testing procedures and in the use of all test equipment.
  - 1. Make tests using a Biddle Megger or equivalent test instrument at a voltage of not less than 1000 VDC; measure resistance from conductor to conductor, conductor to neutral (if present) and from conductor to ground. Insulation resistance shall not be less than the following:

Wire Size (AWG)	Insulation Resistance (Ohms)
#8	250 K
#6 through #2	100 K
#1 through #4/0	50 K
Larger than #4/0	25 K
  - 2. Conductors that do not meet or exceed the insulation resistance values listed above shall be removed, replaced, and retested.
- C. Submittals: Contractor shall furnish instruments and personnel required for tests. Submit 4 copies of certified test results to Architect for review. Test reports shall include conductor tested, date and time of test, relative humidity, temperature, and weather conditions.
- D. Voltage and Current Values: The voltage and current in each conductor shall be measured and recorded after connections have been made and the conductor is under load.



SAMPLE DC HIGH VOLTAGE CABLE TEST REPORT  
(Specification Paragraph 3.2, C)

Date \_\_\_\_\_

Contract and Work Location: \_\_\_\_\_

Contract (Project) No.: \_\_\_\_\_

Circuit Identification: \_\_\_\_\_  
(Dwg., Title, Number and Ckt. Number)

Test Equipment: \_\_\_\_\_  
(Make, Model, Serial No., Etc.)

Applied Test Voltage \_\_\_\_\_

Normal Oper. Voltage \_\_\_\_\_

Cable Installation: New \_\_\_\_\_ Used \_\_\_\_\_  
(Date) \_\_\_\_\_ (No. Years)

Cable Size \_\_\_\_\_ AWG

Cable Length \_\_\_\_\_ Ft.

Cable Material \_\_\_\_\_ Cu \_\_\_\_\_ Al

Temperature \_\_\_\_\_ Humidity \_\_\_\_\_

TEST DATA - RESISTANCE IN KILO OHMS

CONDUCTOR PER PHASE	A-N	B-N	C-N	A-G	B-G	C-G	A-B	B-C	A-C

END OF SECTION

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SECTION 26 05 33  
CONDUIT SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Furnish and install a complete system of electrical conduits and fittings.

1.2 REFERENCE STANDARDS

- A. National Electrical Code  
B. Local codes and ordinances  
C. UL  
D. ETL

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS – Provide products manufactured in the USA

- A. Raceways:  
1. Allied, International Metal Hose, Ipex, Heritage Plastics, Wheatland, Can-Tex, Carlon, Certain-Teed, Anamet, Inc., Electri-Flex Co., Western Tube and Conduit  
2. PVC Coated RGC: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions  
3. Stainless Steel: Robroy, Calbrite, Gibson  
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products  
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass, United Fiberglass
- B. Fittings:  
1. Appleton, Crouse Hinds, Topaz, Steel City, O.Z. Gedney, Carlon, Heritage Plastics, Raco, Ipex, International Metal Hose, Lew Electric Fittings Co.  
2. PVC Coated ferrous fittings: Robroy Perma Cote, Robroy Plasti-Bond, or Calbond – no exceptions  
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds  
4. Aluminum: Penn Aluminum, American Conduit, Wheatland, Eaton B-Line, Patriot Aluminum Products  
5. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass
- C. Condulets and Conduit Bodies:  
1. Appleton, Form 85  
2. PVC Coated: Robroy Perma-cote or Plasti-Bond, – no exceptions  
3. Stainless Steel: Robroy, Calbrite, Gibson, Crouse Hinds  
4. Reinforced Thermosetting Resin Conduit (RTRC): FRE Composites, Champion Fiberglass
- D. Steel MC Cable for light fixture whips:  
1. AFC  
2. Southwire  
3. General Cable  
4. Kaf-Tech

2.2 GENERAL

- A. The minimum conduit size shall be ¾-inch unless indicated otherwise in Divisions 26, 27 or 28.  
1. Branch Circuits: Minimum conduit size shall be ¾-inch.  
2. Feeder Circuits: Minimum conduit size shall be ¾-inches.  
3. Technology, telecommunications, and low voltage systems: The minimum conduit size

- 4. shall be ¾-inches unless noted or indicated otherwise.  
The minimum conduit size between buildings for technology, voice, data, fire alarm, video, security, surveillance, BMCS, and other telecommunications shall be 2-inch unless indicated otherwise.
- B. The minimum conduit size for flexible metallic conduit for tap connections to individual light fixtures shall be ½ inch, or steel metal clad (MC) cable with insulated ground conductor maximum 6 feet.
- C. Electrical nonmetallic tubing, flexible polyethylene or PVC tubing shall not be used on this project.
- D. BX and AC cable shall not be used on this project.
- E. PVC elbows shall not be used on this project.
- F. Intermediate metal conduit (IMC) shall not be used on this project.

## 2.3 RIGID METAL CONDUIT

- A. UL labeled, Schedule 40:
  - 1. Mild steel pipe, zinc coated inside and out
  - 2. Aluminum Alloy 6063, T-1 temper
  - 3. Threaded ends
  - 4. Insulated bushings
- B. Fittings shall meet the same requirements as rigid metal conduits.
  - 1. UL labeled
  - 2. Threaded fittings

## 2.4 ELECTRICAL METALLIC TUBING (EMT)

- A. UL labeled, standard weight:
  - 1. Cold rolled steel tubing, zinc coated inside and out
  - 2. Aluminum Alloy 6005, 6063. Temper T-1
- B. Fittings shall meet the same requirements as EMT conduits.
  - 1. UL labeled
  - 2. Insulated throat connectors
  - 3. Steel fittings with setscrews with lock nuts on threaded ends, no snap locks
  - 4. Cast metal fittings are not approved
  - 5. Uni-couple type connectors are not approved
  - 6. Split ring, anti-short bushings are not approved

## 2.5 RTRC CONDUIT FITTINGS AND CONDUIT BODIES

- A. UL listed
- B. Standard wall thickness sizes ¼-inch through 4-inch
- C. Underground medium wall thickness sizes 5 and 6-inch
- D. Conduit interface joints above grade, gasket joint below grade
- E. Extra heavy wall for above ground and/or UL Class 1 Division 2 and Class 1 Zone 2 applications.

## 2.6 PVC COATED RIGID STEEL WITH URETHANE INTERIOR COATING

- A. The PVC coated galvanized rigid conduit and fittings must be ETL Listed and Verified. The PVC coating must have been investigated and verified by ETL as providing the primary corrosion protection for the rigid metal conduit. Ferrous fittings for general service locations must be ETL Listed with PVC as the primary corrosion protection. Hazardous location fittings, prior to plastic coating must be UL listed for the hazard conditions to which they are to be used. All conduit and fittings must be new, unused material. Applicable UL standards may include UL 6 Standard for

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Safety, Rigid Metal Conduit, and UL514B Standard for Safety, Fittings for Conduit and Outlet Boxes.

- B. The PVC coated galvanized rigid conduit and fittings must be ETL Verified to the Intertek ETL SEMKO High Temperature H<sub>2</sub>O PVC Coating Adhesion Test Procedure for 200 hours. The PVC coated galvanized rigid conduit must bear the ETL Verified PVC-001 label to signify compliance to the adhesion performance standard.
- C. The conduit shall be hot dip galvanized inside and out with hot galvanized threads.
- D. A PVC sleeve extending one pipe diameter or two inches, whichever is less, shall be formed at every female fitting opening except unions. The inside sleeve diameter shall be matched to the outside diameter of the conduit.
- E. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness to protect the coating from tool damage during installation.
- F. Form 8 Condulets, ½-inch through 2-inch diameters, shall have a tongue-in-groove gasket to effectively seal against the elements. The design shall be equipped with a positive placement feature to ease and assure proper installation. Certified results confirming seal performance at 15 psig (positive) and 25 inches of mercury (vacuum) for 72 hours shall be available.
- G. Form 8 Condulets shall be supplied with plastic encapsulated stainless-steel cover screws.
- H. A urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings. This internal coating shall be a nominal 2 mil thickness. Conduit or fittings having areas with thin or no coating shall be unacceptable.
- I. The PVC exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking at temperatures above 30°F (-1°C).
- J. All male threads on conduit, elbows and nipples shall be protected by application of a urethane coating.
- K. All female threads on fittings or conduit couplings shall be protected by application of a urethane coating.
- L. Independent certified test results shall be available to confirm coating adhesion under the following conditions
  - 1. Conduit and conduit exposure to 150°F (65°C) and 95% relative humidity with a minimum mean time to failure of 30 days. (ASTM D1151)
  - 2. The interior coating bond shall be confirmed using the Standard Method of Adhesion by Tape Test (ASTM D3359).
  - 3. No trace of the internal coating shall be visible on a white cloth following six wipes over the coating which has been wetted with acetone (ASTM D1308).
  - 4. The exterior coating bond shall be confirmed using the methods described in Section 3.8, NEMA RN1. After these tests the physical properties of the exterior coating shall exceed the minimum requirements specified in Table 3.1, NEMA RN1.
- M. Right angle beam clamps and U bolts shall be specially formed and sized to snugly fit the outside diameter of the coated conduit. All U bolts shall be provided with plastic encapsulated nuts that cover the exposed portions of the threads.
- N. All fittings, clamps, straps, struts, and hardware used with PVC coated conduit shall be PVC coated or 316 stainless steel

## 2.7 STEEL FLEXIBLE CONDUIT

- A. Steel flexible metallic conduit:
  - 1. Zinc coated inside and out
  - 2. 18-inches minimum length, 24-inches maximum length

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- B. Steel flexible metallic conduit for tap connections to light fixtures where steel MC Cable fixture whips are not used:
  - 1. 18 inches minimum length; 6 feet maximum length
- C. Liquid tight flexible steel conduit
  - 1. Type L.A. - Grounded - UL Approved
  - 2. 18-inches minimum length, 24-inches maximum length

## 2.8 PVC CONDUIT

- A. UL labeled Schedule 40 and Schedule 80
- B. PVC fittings and solvent welded joints
- C. Acceptable PVC conduit manufacturer: Ipex, Cantex

## 2.9 CONDULETS AND CONDUIT BODIES

- A. UL Labeled
- B. Form 85
- C. PVC Coated: Form 8
- D. LBC Condulets shall be used for size 2 inch and above.
- E. LL and LR Condulets shall not be used for 2 inch and above

## 2.10 ROOF MOUNTED CONDUIT AND BOX SUPPORTS

- A. Conduit supports and pads suitable for direct sunlight, conduit size, weight, quantity and roof system with unistrut supports and accessories. Conduit supports shall allow for conduit expansion and contraction.
- B. Refer to roofing specifications for additional information. The limitations and restrictions contained in any roofing specification shall prevail and supercede these specifications for roof mounted supports for conduits and boxes.
- C. Approved Manufacturer:
  - 1. Portable Pipe Hangers
  - 2. Eaton B-Line
  - 3. Miro Industries, Inc.

## 2.11 ALUMINUM CONDUIT

- A. UL Labeled
- B. Aluminum fittings shall meet the same requirements of aluminum conduits, compatible steel fittings.
  - 1. UL Labeled for use with aluminum conduit.

## 2.12 STAINLESS STEEL CONDUIT

- A. UL Labeled
- B. Rigid Stainless Steel:
  - 1. Type 304 Stainless Steel
  - 2. Threaded ends
  - 3. Insulated Bushings
- C. EMT:
  - 1. Type 304 Stainless Steel
  - 2. Compression Fittings

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- 3. Insulated Bushings
- D. Fittings, elbows, nipples, strut, device box, clamps straps, etc.
  - 1. Type 304 Stainless Steel
- 2.13 ELECTRICAL NON-METALLIC TUBING (ENT)
  - A. UL labeled Schedule 40
  - B. PVC fittings and solvent welded joints
  - C. Acceptable manufacture: Carlon
- 2.14 EXTERIOR IN-GRADE PULL BOXES
  - A. Enclosures, boxes and covers are required to conform to all test provisions of the most current American Association of State Highway and Transportation Officials (AASHTO) standards for H-20 loading applications.
    - 1. AASHTO H-20 certified precast concrete, cast iron or other AASHTO recognized materials, rated for deliberate traffic.
    - 2. Conduit entry knock-outs as required
    - 3. Bolt down galvanized steel/cast iron covers
    - 4. Thin wall knocks outs as required
    - 4. Integral bottom
    - 5. Box height as required for specified conduit depth and required top elevation.
    - 6. Concrete design strength of minimum 5,500 PSI at 28-days
    - 7. Place enclosures on a minimum of 6 inches of coarse gravel with a border of 6-inches beyond the enclosures exterior dimension.
    - 8. Size and volume as required for application.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. Install electrical conduits and fittings for all wiring of any type unless specifically specified or instructed to do otherwise. Install conduits and fittings in accordance with local codes and applicable sections of the NECA "Standard of Installation", concealed where possible.
  - 1. Fasten conduit supports to building structure and surfaces; do not support to roof deck.
  - 2. Arrange supports to prevent misalignment during wiring installation.
  - 3. Do not support conduit with wire or perforated pipe straps. Remove wire used for temporary supports.
  - 4. Do not attach conduit to ceiling support wires.
  - 5. Arrange conduit to maintain head room and present neat appearance.
  - 6. Maintain 4-inch clearance between conduit and rooftop surfaces.
  - 7. Cut conduit square using saw or pipe cutter; de-burr cut ends.
  - 8. Bring conduit to shoulder of fittings; fasten securely.
  - 9. Conduit penetrations to all individual motor controllers, VFDs, and motor control cabinets shall only be made at the bottom of the enclosure. For other equipment, provide listed water sealing conduit hubs to fasten conduit to sides or tops of electrical equipment enclosures, device box, gutter, wireway, disconnect, etc.
  - 10. Use suitable caps to protect installed conduit against entrance of dirt and moisture.
  - 11. Ground and bond conduit as required.
  - 12. Identify conduit as required.
  - 13. Route all conduits above building slab perpendicular or parallel to building lines.
  - 14. Do not use no-thread couplings and connectors for galvanized steel, PVC coated galvanized steel, or aluminum rigid conduit.
- B. Group related conduits; support using conduit rack. Construct rack using steel channel; provide space on each for 25 percent additional conduits.
- C. In areas where raceway systems are exposed and acoustical or thermal insulating material is to be installed on walls, partitions, and ceilings, raceways shall be blocked out proper distance to allow

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- insulating material to pass without cutting or fitting. Also provide Kindorf galvanized steel channels to serve as standoffs for panels, cabinets and gutters.
- D. Securely fasten conduits, supports and boxes, to ceiling (not roof deck), walls, with Rawl Plugs or approved equal anchors. Use lead cinch anchors or pressed anchors. Use only cadmium plated or galvanized bolts, screws. Plastic anchors and lead anchors shall not be used for overhead applications.
- E. Provide separate raceway systems for each of the following when specified, indicated or required:
1. 120/208 volt circuits
  2. 277/480 volt circuits
  3. Emergency
    - a. Life safety branch
    - b. Critical branch
    - c. Equipment branch
  4. Voice/Data
  5. Sound reinforcement
  6. Theatrical and Architectural Dimming Controls
  7. MATV/CATV
  8. Security CCTV
  9. Security System
  10. Communications / PA Systems / Sound System Line Input and Speakers
  11. Fire Alarm
  12. Lighting and Building Management Control Systems
- F. Unless shown otherwise, do not install conduit in or below concrete building slabs.
- G. Unless shown otherwise, do not install conduit horizontally in concrete slabs.
- H. Roof penetrations shall be made in adequate time to allow the roofing installer to make proper flashing. Conduit for equipment mounted on roof curbs shall be routed through the roof curb. Conduit, gutters, pull boxes, junction boxes, etc. shall not be routed on roof unless specified otherwise. Where specifically indicated to be routed or mounted on the roof, supports shall be as specified, as recommended by roofing manufacturer and roof support manufacturer and as required by NEC. Place supports every five feet along conduit run and within 3 feet of all bends, condulets, and junction boxes. Provide roofing pad under stands at directed by Architect and as recommended by roofing manufacturer and roof support manufacturer. Provide additional unistrut supports and accessories as required.
- I. PVC coated conduit shall have all nicks and cuts to the protective coating repaired using manufacturer's approved touch-up material as recommended by manufacturer. Provide a minimum of two-wraps of 3M-50 type tape over touch-up.
- J. Installation of the PVC Coated Conduit System shall be performed in accordance with the Manufacturer's Installation Manual. To assure correct installation, the installer shall be certified by Manufacturer to install coated conduit. Submit copies of training certification with submittal. Contractor shall coordinate installation with manufacturer's representative for field training and observation of installed PVC coated rigid galvanized conduit and fittings. Manufacturer's representative shall certify the installation is in accordance with manufacturer's installation instructions. Submit copies of installation certification prior to cover-up of underground installation.
- K. All conduit terminations at locations including but not limited to, switchgear, pull boxes, outlet boxes, stub-up, and stub-outs:
1. Provide insulated throat connectors for EMT conduits.
  2. Provide insulated bushing on all rigid conduit terminations.
  3. Provide locknuts inside and outside of all boxes and enclosures.
  4. Provide threaded type plastic bushing at all boxes and enclosures
- L. In suspended ceilings, support conduit runs from the structure, not the ceiling system construction.
1. Do not support from structural bridging.
  2. Do not support from metal roof deck.

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- M. Completely install each conduit run prior to pulling conductors. All boxes are to be accessible after completion of construction.
- N. All conduits must be kept dry and free of water or debris with approved pipe plugs or caps. Cap or plug conduit ends prior to concrete pours.
- O. Ream ends of conduits after cutting and application of cutting die to remove rough edges.
- P. Install all above concrete slab conduits perpendicular or parallel to building lines in the most direct, neat and workmanlike manner.
  - 1. Cable Tension:
    - a. 0.008 lb./cmil for up to 3 conductors, not to exceed 10,000 pounds.
    - b. 0.0064 lb./cmil for more than 3 conductors, not to exceed 10,000 pounds
    - c. 1000 lbs. per basket grip.
  - 2. Sidewall pressure: 500 lbs./ft.
  - 3. Conduit runs within the following limits of bends and conduit length between pull points shall not exceed the above installation pulling tension and sidewall pressure limits.
    - a. Three (3) equivalent 90-degree bends: not more than fifty feet (50') between pull points.
    - b. Two (2) equivalent 90-degree bends: not more than one hundred feet (100') between pull points.
    - c. One (1) equivalent 90-degree bend: not more than one hundred fifty feet (150') between pull points.
    - d. Straight pull: not more than two hundred feet (200') between pull points.
  - 4. Indicate sizes of conduits, wireway sections, and cable tray sections on the as-built drawings.
  - 5. Hold horizontal and vertical conduits as close as possible to walls, ceilings and other elements of the building construction. Conduits shall be kept a minimum of 6 inches clear of roof deck / insulation, and 2 inches clear of above floor deck / insulation.
  - 6. Install conduits to conserve building space and not obstruct equipment service space or interfere with use of space. Conduit shall not be routed on floors, paved areas or grade.
  - 7. Where a piece of equipment is wired from a switch or box on adjacent wall, the wiring shall go up the wall from the box, across at or near the ceiling, and back down to the equipment. Wiring shall not block the walkway between wall and equipment.
  - 8. Horizontal runs of conduit on exposed walls shall be kept to a minimum.
  - 9. Conduit for mechanical / plumbing equipment installed outdoors shall be routed with the associated mechanical / plumbing pipe support rack system where practical, coordinate with Divisions 22 and 23.
  - 10. Conduits installed in public areas, not concealed by architectural ceilings, shall be supported by galvanized steel channel racks to bottom of roof deck or floor deck. Conduits shall be grouped for neat workman-like appearance.
- Q. Install expansion and deflection fittings and bonding jumpers on straight runs which exceed 200-feet, on center, and at 200-feet maximum, on center, on straight runs which exceed 400-feet, and where conduits cross building expansion joints.
- R. Provide grounding bushings at concentric/eccentric knockouts or where reducing washers are used.
- S. Run conduit to avoid proximity to heat producing equipment, piping surfaces with temperatures exceeding 104 degrees F., and flues, keeping a minimum of 13-inches clear.
- T. Install conduit as a complete system, without conductors, continuous from outlet to outlet and from fitting to fitting. Make up threaded joints of conduit carefully in a manner to ensure a tight joint. Fasten the entire conduit system into position. A run of conduit between outlet and outlet, between fitting and fitting, or between outlet and fitting shall not contain more than the equivalent of four quarter bends, including those bends located immediately at the outlet or fitting.
- U. Conceal conduit systems in finished areas. Conduit may be exposed in mechanical and electrical rooms, and where otherwise shown or indicated only. Run the conduit parallel and perpendicular to the structural features of the building and support with malleable iron conduit clamps at intervals as required by NEC or on conduit racks, neatly racked and bent in a smooth radius at corners.

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- V. Conduit bends shall be factory elbows or shall be bent using equipment specifically designed to bend conduit of the type used to maintain the conduit's UL listing. Conduit hanger spacing shall be 10 feet or less and as required by the NEC for all conduit. Beam clamp attachments to steel joist chords is prohibited. Beam clamps may only be used at beams, no exceptions. Connections to joists shall be made with galvanized channel extended between joist chords or with galvanized channel bearing on the vertical legs of joist chord angles.
- W. Support conduit on galvanized channel, using compatible galvanized fittings (bolts, beam clamps, and similar items), and galvanized threaded rod pendants at each end of channel and secure raceway to channel and channel to structure. Where rod pendants are not used, channel supports are to be secured to structure at each end. Conduit supports are to be secured to structure using washers, lock washers, nuts and bolts or rod pendants; use of toggle bolt "wings" are not acceptable. Support single conduit runs using a properly sized galvanized conduit hanger with galvanized closure bolt and nut and threaded rod. Raceway support system materials shall be galvanized and manufactured by Kindorf, Unistrut, Superstrut, Caddy, or Spring Steel Fasteners, Inc. Provide chrome or nickel-plated escutcheon plates on conduit passing through walls and ceilings in finished areas. Do not support conduit from other conduit, structural bridging or fire rated ceiling system. Do not support more than one conduit from a single all-thread rod support. Provide electrical insulating sleeve or wrapping for aluminum conduit supported by zinc coated supports or fasteners. Channel supports shall have cut ends filed smooth. When installed outside of the building, or in areas subject to moisture, the cut ends shall be painted with ZRC galvanized paint or equivalent.
- X. Terminate all motor connection conduits in mechanical room spaces with a floor pedestal and with "Tee" conduit at motor outlet height for flexible conduit.
- Y. Where conduit is not embedded in concrete or masonry, conduit shall be firmly secured by approved clamps, half-straps or hangers. Tie wire and short pieces of conduit used as supports and or hangers are not approved.
- Z. Where "LB" condulets are used, 2-inches and larger shall be type "LBD".
- AA. No more than 12 conduits containing branch circuits may be installed in junction boxes, pull boxes or gutters.
- BB. Flexible metal conduit and liquid tight flexible metal conduit shall only be used for final connections from junction box to equipment, light fixtures, power poles, etc. They are not to be used in lieu of conduit runs. They shall not be used for wall or roof penetrations unless they are installed in a PVC coated RGC conduit sleeve at least one size larger than the OD of the flexible conduit.
- CC. Where 3-1/2-inch conduit is specified and the required or specified material is Schedule 80 PVC, provide 4-inch conduit.
- DD. "Daisy Chaining" light fixtures installed for lay-in ceiling areas is not allowed. Each light fixture shall have its own fixture whip from junction box. The only exception being light fixtures installed end to end using chase nipples between them, or light fixtures recessed in non-accessible ceilings.
- EE. In above ceiling applications, do not install raceways, junction boxes, gutters, disconnects, etc. within 36 inches directly in front of HVAC control boxes or other equipment requiring access from a point starting from the top of control box / equipment down to ceiling.
- FF. Do not install conduit, junction boxes, etc. within 18 inches of outside edges of roof access openings.
- GG. Install minimum size 2-inch nipple, at least one, between multi-sectional panels for branch circuit independent of feeder conductors.

### 3.2 CONDUITS

- A. Conduit above grade indoors:
  - 1. Concealed Conduits: EMT with set screw fittings

2. Exposed conduits:
  - a. Below nine feet AFF where not directly attached and against building walls, ceiling, or structure: Rigid metal conduit or x-wall RTRC.
  - b. Where subject to physical damage: Rigid metal conduit or x-wall RTRC.
  - c. Wet locations: PVC coated galvanized rigid steel or aluminum conduit
  - d. Damp Locations: Aluminum rigid conduit or x-wall RTRC.
  - e. Exposed conduits in mechanical rooms or electrical rooms shall be rigid galvanized steel or x-wall RTRC when installed below 18-inches above finished floor.
- B. Conduit installed above grade outdoors:
  1. Galvanized rigid steel or x-wall RTRC for conduits up utility poles and where subject to physical damage or where located less than four feet above finished floor.
  2. Aluminum or x-wall RTRC where not subject to physical damage and where located four feet above finished floor.
- C. Conduit where indicated underground:
  1. PVC Coated Galvanized rigid steel or RTRC conduit elbows and Schedule 80 PVC, RTRC, or PVC coated galvanized steel straight run conduits. PVC conduits for underground branch circuits shall be Schedule 80 or Schedule 40 PVC.
    - a. PVC conduit and fittings shall be used only for straight horizontal runs and for vertical risers at site lighting pole bases. Bending straight sections of PVC conduit to less than 25-foot radius or the use of PVC factory bends is not allowed.
    - b. Change in direction of conduit runs, either vertical or horizontal, shall be with RTRC or PVC coated galvanized steel elbows or long sweep bends of straight PVC conduit sections. Long sweep bends of straight PVC 20-foot sections shall have a minimum radius of curvature of 25 feet and a maximum arc of 22.5degrees. Multiple long sweep bends of straight PVC sections shall be separated by a minimum of 20-feet of straight, linear, PVC sections.
    - c. Provide RTRC or PVC coated rigid galvanized steel conduit elbows and fittings with urethane interior coating at all changes in direction with radius of less than 25-feet and at all vertical runs to 18 inches above finished floor elevation. For interior slab penetrations, provide continuous RTRC or PVC coated rigid galvanized steel conduit and fittings with urethane interior coating from change in direction to 18 inches above finished floor elevation, except where stubbed-up under and inside equipment or switchgear where conduit shall be terminated at minimum two inches above concrete housekeeping pad.
    - d. Elbows for underground electrical service entrance, feeders, transformer primary / secondary, telecommunication, and low voltage conduits shall be RTRC or PVC coated rigid galvanized steel with long radius as follows:
      - 1) Up to 1-inch conduit, minimum 12-inch radius.
      - 2) 1.5-inch conduit, minimum 18-inch radius.
      - 3) 2-inch conduit, minimum 24-inch radius.
      - 4) 2.5-inch conduit, minimum 30-inch radius.
      - 5) 3-inch conduit, minimum 36-inch radius.
      - 6) 3.5 to 6-inch conduit, minimum 48-inch radius.
    - e. Conduit for all floor boxes shall be routed below building slab from floor box to nearest column, wall, or as indicated.
    - f. Conduits shall not be routed horizontally in building slab, grade beams or pavement.
  2. Encase all underground conduits in concrete.
    - a. Concrete shall be tinted red throughout with a ratio of 10 pounds of dye per yard of concrete unless prohibited by utility for utility conduits. Concrete encasement for utility installed conductors shall be as specified by the utility and comply with their standards and specifications. Where utility does not require but allows concrete encasement of conduits, provide concrete encasement as specified herein.
    - b. Provide minimum 3-inch concrete encasement around conduits.
    - c. Provide conduit spacers for parallel branch/feeder conduits.
    - d. When prior written approval from Owner and Architect to omit concrete encasement of conduits below building slab is given, conduits either specified or

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- approved in writing to be routed under building slab without concrete encasement for electrical branch circuits or voice / data / video / communications horizontal drops or outlets shall be installed 18 inches below finished floor and on select fill. All other conduits, including but not limited to electrical feeders, voice / data / video / communications vertical, riser, tie, trunk, or service cable conduits shall be installed 48-inches below finished floor and on select fill.
- e. Use suitable manufactured separators and chairs installed 4 feet on centers. Securely anchor conduit at each chair to prevent movement during backfill placement.
3. Install building voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits with top of concrete encasement minimum 48-inches below finished grade or pavement. Voice / data / video / communications conduits and electrical service primary conduits for utility owned electrical service transformers shall also comply with the respective utility company requirements and standards. All other underground conduits outside of building other than voice / data / video / communications main service conduits and electrical service transformer primary and secondary conduits shall have top of concrete encasement at 36 inches minimum below finished grade or pavement.
4. Provide two "caution" plastic tapes at 6-inches and 18-inches below finished slab, grade, or pavement; identify as specified in Section 26 05 00.
5. Conduits located outside building, provide magnetic locator tape at top of first compacted layer of backfill or concrete.
6. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel with diameter 1/4-inch smaller than the conduit, shall be drawn through each conduit. A brush with stiff bristles shall be drawn through until conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
7. Utility underground conduit for Utility Company cable shall be installed per Utility Company standards, and their specifications for this project.
8. Concrete shall be Portland Cement conforming to ASTM-C-150, Type 1, Type III or Type V if specified. Cement content shall be sufficient to product minimum strength of 2,500 PSI.
9. Contractor shall stake out routing and location of underground conduits using actual field measurements. He shall obtain approval of the Owner and Architect before beginning trenching, horizontal drilling, and excavation.
10. Verify location and routing of all new and existing underground utilities with the Owner and Architect on the job site. Stake out these existing utilities so that they will not be damaged. Stake out new utilities to provide coordination with other trades and with new and existing utilities, easements, property lines, restricted land use areas, and right-of-ways. Verify existing public utilities with Call811.
- D. Conduit shown in concrete walls, floor or roof slab:
1. PVC Coated Galvanized Rigid steel.
- E. Conduits that penetrate concrete slab, or within 100 feet of cooling towers, or at designated corrosive locations.
1. RTRC
2. PVC coated galvanized rigid steel
- F. Connections to equipment mounted on roof, rotating equipment, transformers, and kitchen or food processing equipment, or where flexible conduit is required outdoors.
1. Liquid tight flexible metal conduit (1/2 inch may be used for roof top supply / exhaust fans only)
2. Liquid tight flexible metal conduit for 24-inch maximum length
3. Conduit for roof-mounted equipment shall be routed inside the roof curb assembly roof opening. Provide permanent lock-off device at panelboard circuit breakers serving roof equipment and accessories to enable tag-out procedures for all power routed through roof curb and to the roof mounted equipment and accessories.
- G. Light fixture whips:
1. Accessible ceilings and open structure: 1/2-inch flexible steel conduit or steel MC cable,

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- length not to exceed 6-feet.
- 2. Non-accessible ceilings: ½-inch flexible steel conduit. Length as required to make a tap at an accessible j-box. Recessed light fixtures in non-accessible ceilings may be daisy chained using the light fixture's integral, UL listed j-box or internal wire way that is accessible through fixture from below the ceiling.
- 3. Dedicated insulated ground wire.
- 4. Light fixture whips shall not rest on ceiling grid or tile.
- 5. Light fixture whips shall not be supported from the ceiling suspension system. Support from the structure with #13 AWG galvanized iron wire pendants and Caddy clips. Do not support conduit from structural bridging. Flexible conduit and steel MC cable shall be kept a minimum of 2 inches clear of roof deck.
- H. Conduits at Natatorium or therapeutic pool areas:
  - 1. Underground conduit shall be as specified in this section.
  - 2. Exterior conduits and boxes within 100 feet of exhaust openings shall be x-wall RTRC or PVC coated galvanized rigid steel or stainless steel.
  - 3. Exposed conduits in chemical storage rooms, pool mechanical equipment (pump rooms, and pool equipment storage rooms shall be Schedule 80 PVC. Boxes shall be PVC, or 304 Stainless Steel.
  - 4. Exposed conduits and boxes in indoor pool areas and all other indoor public areas shall be Type 304 Stainless Steel.
- I. Conduits located inside greenhouses and natatorium pump and water treatment rooms:
  - 1. X-wall RTRC
  - 2. Schedule 80 PVC
  - 3. PVC coated galvanized rigid steel conduit and fittings.
- J. Conduits in classified hazardous (Classified) locations:
  - 1. Conduit fittings and seals UL listed for the classification
- K. Conduits embedded in parking structure traffic wearing surface and concrete support structures:
  - 1. Schedule 40 PVC, RTRC, PVC coated rigid galvanized conduit.
  - 2. Schedule 40 ENT may only be used for flat runs embedded in traffic wearing surface concrete topping.
  - 2. Solvent welded fittings only for PVC conduit and ENT.
  - 3. Verify with Structural Engineer prior to construction for any additional limitations for raceway installation restrictions installed in parking structure including but not limited to maximum outside diameter of raceways permitted to be used in the wearing surface, and field cutting or drilling through parking structure structural members or support structures.
  - 4. All raceways shall be securely fastened to prevent floating during concrete installation. ENT raceways shall be completely embedded in concrete material to maintain fire and smoke integratory as required by the NEC.
  - 5. When using ENT or PVC conduits, provide transition to x-wall RTRC or PVC coated rigid galvanized conduit elbows and vertical risers to ensure that only flat horizontal runs of PVC conduit or ENT are used along the top of the parking structure structural support deck and that they are completely concealed and embedded by the wearing surface concrete material topping.

### 3.3 CONDUIT PENETRATIONS, SLEEVES AND ESCUTCHEONS

- A. Furnish sleeves for placing in construction for all conduit passing through concrete or masonry walls, partitions, beams, all floors other than grade level, and roofs. A conduit sleeve shall be one size larger than the size of conduit, which it serves except where larger sizes are required for manufactured water, fire, or smoke stop fittings.
  - 1. Sleeves set in concrete floor construction shall be minimum Schedule 40 galvanized steel.
  - 2. Sleeves shall extend 3-inches above the finished floor.
- B. Sleeves in concrete or masonry walls shall be RTRC or Schedule 40 galvanized steel. Sleeves shall be set flush with finished wall.
- C. Install manufactured UL listed water, fire, and smoke stop fittings, or caulk around conduit or cables in sleeves with sufficient UL listed fire safe insulation or foam to maintain wall or floor slab fire or

### CONDUIT SYSTEMS

smoke rating. Refer to Architecture drawings for locations of rated walls.

- D. Provide Linkseal Mechanical Seals around conduit penetrations through walls below grade. Provide a pull box to install a water stop inside wall penetration. Internally seal low voltage cabling conduit penetrations with waterproof caulking.
- E. Sleeves penetrating walls below grade shall be Schedule 40 black steel pipe with ¼-inch thick steel plate secured to the pipe with continuous fillet weld. The plate shall be located in the middle of the wall and shall be 2-inches wider all around than the sleeve that it encircles. The sleeve should extend a minimum of 24-inches on either side of the penetration. The entire assembly shall be hot-dipped galvanized after fabrication. Do not sleeve or penetrate grade beams.
- F. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with a threaded steel bushing. Route conduit through roof openings, for piping and ductwork or through suitable roof jack, with pitch pocket. Coordinate location with roofing installation as required.
- G. Conduit passing through fire rated wall shall be sealed with Fire Stop. Route conduit to preserve fire resistance rating of partitions and other elements, using materials and methods under the provisions of Division 7.

### 3.4 POWER DISTRIBUTION UNDERGROUND FEEDER CONDUIT AND UNDERGROUND SERVICE ENTRANCE CONDUIT

- A. Power underground feeder and service entrance shall be of individual conduit encased in concrete. Unless shown otherwise, the type of conduit used shall not be mixed in any one underground conduit and shall be the size indicated on the drawings. The concrete encasement surrounding the underground conduit shall be rectangular in cross-section, having a minimum concrete thickness of 3-inches, except that conduit for 120V and above shall be separated from control and signal conduits by a minimum concrete thickness of 3-inches. Encasement concrete shall be tinted in red.
- B. During construction, partially completed underground conduits shall be protected from the entrance of debris such as mud, sand, and dirt by means of conduit plugs. As each section of the underground conduit is completed, a testing mandrel shall be drawn through until each conduit is clear of particles of earth, sand, or gravel. Conduit plugs shall then be installed.
- C. Furnish the exact dimensions and location of power underground conduit to be encased in time to prevent delay in the concrete work.
- D. Conduit for service entrance underground conduits shall be as indicated on the drawings.
- E. Primary power underground conduit shall be installed in accordance with utility company standards and the utility company specifications for this project.

### 3.5 TELECOMMUNICATIONS, LOW VOLTAGE AND EMPTY CONDUIT SYSTEM RACEWAYS

- A. Conduit shall be installed in accordance with the specified requirements for conduit and with the additional requirements that no length of run shall exceed 100-feet for 1 inch or smaller trade sizes and shall not contain more than two 90-degree bends or the equivalent. Pull or junction boxes shall be installed to comply with these requirements. Provide plastic bushings at all conduit terminations. Provide a grounding bushing on each data and voice conduit.
- B. Conduits shall be installed from outlet box to above an accessible ceiling. All cables routed through open spaces (no-ceiling below roof deck or above floor deck) shall be routed in conduit. Telecommunications systems, CATV, CCTV, fire alarm and BMCS cables can be installed above accessible ceilings without conduit. Cables installed above accessible ceiling shall be plenum rated. Conduit rough in of these cables shall include a 90-degree turn-out to an accessible location with insulated bushings on the end of the conduit.
  - 1. Provide conduit from each telecommunications outlet box to accessible ceiling plenum.
  - 2. Provide conduit from each security / surveillance device outlet box to accessible ceiling plenum.
  - 3. Provide two conduits for each multi-media outlet box and each outlet box indicated to

## CONDUIT SYSTEMS

- contain more than four data, audio, or video drops to accessible ceiling plenum.
4. Provide the following minimum conduits for telecommunications and multi-media wall, floor, and ceiling mounted outlet boxes. Use the largest diameter conduit indicated below unless instructed otherwise in writing from the Architect:
- Non-masonry outlet box: Two 1-inch conduits.
  - Masonry outlet box: Two 1-inch conduits, or three 3/4-inch conduits.
  - Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation.
- C. All conduit in which cable is to be installed by others shall have pull string installed. The nylon pull string shall have not less than 200 lb. tensile strength. Not less than 12-inches of slack shall be left at each end. Provide blank cover plate before substantial completion if box is for a future installation after substantial completion of the project. Conduit shall extend to a minimum six inches above nearest accessible ceiling and be turned horizontally with plastic bushing at terminations.
- D. Conduits for Building Entrance Facilities:
- Underground Outside Plant: Install a pull box every 300-feet or after 180 degree turns.
  - Inside Plant: Install a pull box every 150-feet or after 180 degree turns. All turns shall be large sweeps, not sharp 90s, with the radius of the sweep at least 10X the diameter of the conduit. Hence, a 4-inch conduit requires a 40-inch minimum radial sweep. If field conditions absolutely mandate a sharp 90-degree bend to be installed, then a pull box shall be installed at that location regardless of distance.
  - Building entrance facilities shall not terminate in an IDF or any other space except the MDF.
  - Coordinate the termination location of the building entrance facilities in the MDF with the room layout and equipment configuration.
  - Provide 4-inch conduit unless indicated otherwise. Provide (3) fabric innerducts in each 4-inch conduit.
- 3.6 EXTERIOR IN-GRADE PULL BOXES
- A. Provide pull boxes where specified and as required.
- B. Pull boxes located in pavement shall be set with proper extensions so that top of cover is flush with pavement.
- C. Pull boxes located in non-paved areas shall be set two-inches above surrounding finished grade. Provide 12-inch wide by 8-inch deep reinforced concrete crown around neck or opening and sloped down away from pull box opening.

3.7 IDENTIFICATION

- A. Conduit Systems: Provide adequate marking of conduit larger than one inch exposed or concealed in interior accessible spaces to distinguish each run as either a power (120/208V or 277/480V) or signal / telecommunication conduit (Fire Alarm, BAS, BMCS, Security, CCTV, Access Control, Intrusion Detection, Telecom, etc.). Except as otherwise indicated, use orange banding with black lettering. Provide self-adhesive or snap-on type plastic markers. Locate markers at ends of conduit runs, near switches and other control devices, near items of equipment served by the conductors, at points where conduit passes through walls or floors or enters non-accessible construction, and at spacing of not more than 50-feet along each run of exposed conduit. Switch-leg conduit and short branches for power connections need not be marked, except where conduit is larger than 1-inch.

END OF SECTION

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SECTION 26 05 35

ELECTRICAL CONNECTIONS FOR EQUIPMENT

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Electrical connections as required and scheduled, and as specified.

1.2 RELATED WORK

- A. Refer to other Divisions for specific individual equipment electrical requirements.

1.3 QUALITY ASSURANCE

- A. UL Label: Products shall be UL listed to the extent possible.

PART 2 - PRODUCTS

2.1 MATERIALS AND COMPONENTS

- A. General: For each electrical connection indicated, provide a complete assembly including, but not limited to, pressure connectors, terminals (lugs), electrical insulating tape, heat-shrinkable insulating tubing, cable ties, solderless wire nuts, and other items and accessories needed to complete splices and terminations.
- B. Raceways: Refer to related sections.
- C. Conductors and Connectors: Refer to related section. Conductors at equipment terminations shall be copper.
- D. Terminals: Provide electrical terminals as indicated by the terminal manufacturer for the application.

PART 3 - EXECUTION

3.1 INSTALLATION OF ELECTRICAL CONNECTIONS

- A. General: Install electrical connections as shown, in accordance with applicable portions of the NECA Standard of Installation, and industry practices.
- B. Conductors: Connect electrical power supply conductors to equipment conductors in accordance with equipment manufacturer's written instructions and wiring diagrams. Where possible, match conductors of the electrical connection for interface between the electrical supply and the installed equipment.
- C. Splice Insulation: Cover splices with electrical insulation equivalent to, or of a higher rating than, insulation on the conductors being spliced.
- D. Appearance: Prepare conductors by cutting and stripping covering, jacket, and insulation to ensure a uniform and neat appearance where cables and wires are terminated.
- E. Routing: Trim cables and wires to be as short as practical. Arrange routing to facilitate inspection, testing, and maintenance.
- F. Motor Connections: Where possible, terminate conduit in conduit boxes at motors. Where motors are not provided with conduit boxes, terminate the conduit in a suitable conduit, and make motor connections. Conduit passing through the housing on connected equipment shall pass through a cleanly cut hole protected with an approved grommet. For all AHU or fan motors and all other motors 10 HP and larger, at the motor connection do not use wire nuts. Provide copper alloy split bolt connectors or compression lugs and bolts. Insulate connection with Scotch Super 88 vinyl electrical tape over rubber tape, or Tyco Gelcap Motor Connection Kit.

ELECTRICAL CONNECTIONS FOR EQUIPMENT

- G. Conduit connections to equipment including, but not limited to, Variable Frequency Drives, Manual and Automatic Transfer Switches, Surge Suppression Devices, motor controllers, electrical disconnects, food service / processing equipment, electronics, control panels and Owner furnished equipment:
1. Make conduit penetrations only at the bottom flat surface of the equipment and only where permitted by the equipment manufacturer to avoid un-intentional water entry. Coordinate installation of electrical connections for equipment with equipment installation work. Where equipment manufacture does not permit a bottom conduit entry, verify with Owner/Engineer and locate the conduit entry at the side surface as close as possible to the bottom of the enclosure.
  2. Where conduit originates from an elevation above the conduit entry, provide a "T" conduit below the enclosure's bottom elevation. Provide conduit from the conduit up to the enclosure bottom horizontal surface for electrical connection.
- H. Identification: Refer to Electrical General Provisions for identification of electrical power supply conductor terminations with markers approved as to type, color, letter and marker size by the Architect. Fasten markers at each termination point, as close as possible to each connecting point.
- I. Equipment and Furnishings: Refer to other Divisions. Coordinate power and control provisions shown for equipment and furnishings with the provisions required for the furnished equipment and furnishings. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements.
- J. Elevators and Escalators, and Wheelchair Lifts: Refer to Other Divisions. Coordinate power and control provisions shown with the provisions required for the furnished equipment. Where the power and control requirements are less than or equal to those specified, modifications to power and control provisions shall be made at no cost as a part of coordination. Where power and control requirements are in excess of those shown, notify the Architect in writing of the requirements. Provide lockable disconnect switches for main power, control power, lighting power, etc. as required by the NEC and all local codes. Provide all necessary means of two-way communication for emergency phones.

END OF SECTION

SECTION 26 05 37

ELECTRICAL BOXES AND FITTINGS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide electrical box and fitting work as required, scheduled, indicated, and specified.

1.2 QUALITY ASSURANCE

- A. UL Label: Electrical boxes and fittings shall be UL listed.

PART 2 - PRODUCTS— Provide products manufactured in the USA

2.1 FABRICATED MATERIALS

- A. Interior Outlet Boxes: Provide galvanized steel interior outlet wiring boxes, of the type, shape, and size, including depth of box, to suit respective locations and installation. Construct with stamped knockouts in back and sides. Provide gang boxes where devices are shown grouped. Single box design; sectional boxes are not acceptable, except for wall mounted electronic displays.
1. Type of Various Locations:
    - a. Wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations; recessed wall mounted box for power and/or multi-media (low voltage) outlets: Arlington Industries #TVBS 613, 4-gang steel box with white trim plate.
    - b. Technology, data, voice, video and multi-media outlet boxes at locations other than wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations: minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes. Raco #260H large capacity box with ½ through 2-inch knockouts.
    - c. Security, access control, and video surveillance outlet boxes: single gang, 3-inch deep outlet boxes mounted long axis vertically.
    - d. All other applications: minimum 4-inch square (2-gang) 2-1/8-inch deep boxes.
    - e. Masonry Walls: Galvanized switch boxes made especially for masonry installations; depths of boxes must be coordinated for each installation.
    - f. Surface: Type FS or FD box with surface cover.
    - g. Corrosive locations or natatorium areas: 316 stainless steel construction suitable for the installation.
    - h. Hazardous (Classified) Locations: Explosion proof boxes, seals and fittings.
    - i. Special: Where above types are not suitable, boxes as required, taking into account space available, appearance, and Code requirements
  2. Interior Outlet Box Accessories: Outlet box accessories required as for installation, including covers or wall device plates, mounting brackets, wallboard hangers, extension rings, plaster rings for boxes in plaster construction, fixture studs, cable clamps and metal straps for supporting outlet boxes. Accessories shall be compatible with outlet boxes used and meet requirements of individual wiring.
- B. Damp Location Outlet and Damp or Wet Location Switch Boxes: Deep type, hot dipped galvanized cast-metal weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends, and stainless steel cover plate with spring-hinged waterproof caps suitable for application. Include faceplate gasket and corrosion-resistant, tamper / vandal proof fasteners.
- C. Wet Location Outlet Boxes: Hot dipped galvanized cast-iron weatherproof outlet wiring boxes, of type, shape, and size required. Include depth of box, threaded conduit ends.
- D. Junction and Pull Boxes: Galvanized sheet steel junction and pull boxes, with screw-on covers, of type, shape, and size, to suit respective location and installation.
1. Type for Various Locations:
    - a. Minimum Size: 4-inch square, 2-1/8-inches deep.

ELECTRICAL BOXES AND FITTINGS

- b. 150 Cubic Inches in Volume or Larger: Code gauge steel with sides formed and welded, screw covers unless shown or required to have hinged doors. All boxes mounted above ceiling shall have screw covers. Boxes in all other areas with covers larger than 12-inches shall have hinged with screw covers. Knockouts factory stamped or formed in field with a cutting tool to provide a clean symmetrically cut hole.
  - c. Exterior or Wet Areas: 304 stainless steel NEMA 4X construction with gaskets and corrosion-resistant fasteners
- E. Conduit Bodies: Provide galvanized cast-metal conduit bodies, of type, shape, and size, to suit location and installation. Construct with threaded conduit ends, removable cover, and corrosion-resistant screws.
- F. Bushings, Knockout Closures, and Locknuts: Provide corrosion-resistant punched-steel box knockout closures, conduit locknuts, and insulated conduit bushings of type and size to suit use and installation.
- G. Outlet boxes in fire rated walls: Provide 2-hour rated gasket within box and below cover, equal to Rectorseal Metacaulk box guard and cover guard.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION OF BOXES AND FITTINGS

- A. Install electrical boxes and fittings as shown and as required, in compliance with NEC requirements, in accordance with the manufacturer's written instructions, in accordance with industry practices.
- B. Provide recessed device boxes for wall mounted interactive media boards, video displays, televisions, electronic signage and similar installations.
- C. Provide minimum 4-inch square (2-gang), 3-inch deep interior outlet boxes for technology, data, voice, video, and multi-media outlet boxes at locations other than wall mounted interactive boards, video or visual displays. Provide single gang only, 3-inch deep outlet boxes mounted long axis vertically for security, access control, and video surveillance, coordinate with security equipment installation. Provide minimum 4-inch square (2-gang) 2-1/8-inch deep boxes for all other applications. Where indicated differently on plans or where conflicts arise, notify the Architect / Engineer prior to installation. Box extenders or plaster rings shall not be used to increase size. Provide increased box size as required.
- D. Junction and pull boxes, condulets, gutters, located above grid ceilings shall be mounted within 18-inches of ceiling grid. Junction and pull boxes above grid ceilings shall be mounted in the same room served. Junction boxes and pull boxes required for areas with inaccessible ceilings shall be located above the nearest accessible ceiling area. All junction box or pull box openings shall be side or bottom accessible. Removal of light fixtures, mechanical equipment or other devices shall not be required to access boxes. Outlet boxes above ceiling for low voltage terminations shall face towards the floor.
- E. Use outlet and switch boxes for junctions on concealed conduit systems except in utility areas where exposed junction or pull boxes can be used.
- F. Determine from the drawings and by measurement the location of each outlet. Locate electrical boxes to accommodate millwork, fixtures, marker boards, and other room equipment at no additional cost to the Owner. The outlet locations shall be modified from those shown to accommodate changes in door swing or to clear interferences that arise from construction as well as modifying them to center in rooms. The modifications shall be made with no cost as part of coordination. Check the conditions throughout the job and notify the Architect of discrepancies. Verify modifications before proceeding with installation. Set wall boxes in advance of wall construction, blocked in place and secured. Set all wall boxes flush with the finish and install extension rings as required extending boxes to the finished surfaces of special furring or wall finishes. Provide wall box support legs attached to stud to prevent movement of box in wall.

#### ELECTRICAL BOXES AND FITTINGS

- G. Unless noted or directed otherwise at installation, place outlet boxes as indicated on architectural elevations and as required by local codes.
- H. Outlets above counters, mount long axis horizontally. Refer to architectural elevations and coordinate to clear backsplash and millwork.
- I. Provide pull boxes, junction boxes, wiring troughs, and cabinets where necessary for installation of electrical systems. Surface mounted boxes below 9 feet and accessible to the public shall not have stamped knockouts.
- J. Provide weatherproof boxes for interior and exterior locations exposed to weather or moisture.
- K. Provide knockout closures to cap unused knockout holes in boxes.
- L. Locate boxes and conduit bodies to ensure access to electrical wiring. Provide minimum 12-inch clearance in front of box or conduit body access.
- M. Secure boxes to the substrate where they are mounted, or embed boxes in concrete or masonry.
- N. Boxes for any conduit system shall not be secured to the ceiling system, HVAC ductwork or piping system.
- O. Provide junction and pull boxes for feeders and branch circuits where shown and where required by NEC, regardless of whether or not boxes are shown.
- P. Coordinate locations of boxes in fire rated partitions and slabs to not affect the fire rating of the partition or slab. Notify the Architect in writing where modification or construction is required to maintain the partition or slab fire rating.
- Q. Exterior boxes installed within 50-feet of cooling towers or water treatment areas shall be of 304 stainless steel, weatherproof NEMA 4X construction.
- R. Identification: Paint the exterior and cover plates of building interior junction boxes and pull boxes located above accessible ceilings or non-finished areas to correspond to the following colors:
  - 1. Orange: - 480/277 VAC systems
  - 2. Light Blue: - 240 VAC three phase delta systems.
  - 3. Red – All Emergency circuits, regardless of voltage, and fire alarm system.
  - 4. Light Green - 120/208 VAC 3 phase and 120/240 VAC single-phase systems
  - 5. Yellow – Building Management and Control System - BMCS
  - 6. White - Security and Surveillance equipment circuits
- S. All box covers shall be labeled with Panel ID and circuit numbers of all circuits available in box using permanent black marker. Boxes containing main feeders are to list where fed from and load (example "MSB to Panel HA"). Information listed is to be legible, markovers are not acceptable. Multi-sectional panel numbers are not to be listed on covers (example "LA2" referring to Panel LA sec. 2 is to be listed as "LA"). Label covers for special applications explaining contents (example "Emerg. Gen. Annunciator controls", "IDF ground"). Do not attach box covers that have both sides painted or labeled differently. In public areas where boxes are painted same color as room per architect, label inside covers. Boxes that are not used shall be labeled as not used and include panel ID. Example "Not Used Panel LA". Unused raceways not in sight of panel shall be terminated in a box and labeled not used and include panel identification.
- T. Align adjacent wall mounted outlet boxes for switches, thermostats, and similar devices.
- U. Use flush mounting outlet box in finished areas unless specifically indicated as being used with exposed conduit.
- V. Locate flush-mounting box in masonry wall to require cutting of masonry unit corner only. Coordinate masonry cutting to achieve neat opening.
- W. Do not install flush mounting box back-to-back in walls; provide minimum 6 inches with stud separation. Provide minimum 24 inches with separation in acoustic rated walls.

ELECTRICAL BOXES AND FITTINGS

- X. Secure flush mounting box to interior wall and partition studs. Accurately position to allow for surface finish thickness. Provide UL listed materials to support boxes in walls to prevent movement. Ensure box cannot be pushed inside wall.
- Y. Use stamped steel bridges to fasten flush mounting outlet box between studs.
- Z. Install flush mounting box without damaging vapor barriers, wall insulation or reducing its effectiveness.
- AA. Use adjustable steel channel fasteners for hung ceiling outlet box.
- BB. Do not fasten boxes to ceiling support wires.
- CC. Support systems are to hang vertically straight down. All-thread supports, when used, are not to be installed at an angle or bent.
- DD. Use gang box where more than one device is mounted together. Do not use sectional box.
- EE. Use gang box with plaster ring for single device outlets.
- FF. Support outlets flush with suspended ceilings to the building structure.
- GG. Mount boxes to the building structure with supporting facilities independent of the conduits or raceways.
- HH. Where multiple feeders are in one pull box, conductors shall be wrapped with 3M No. 7700 Arc and fireproof tape.
- II. Provide plaster rings of suitable depth on all outlet boxes. Face of plaster ring shall be within 1/8 inch from finished surface.
- JJ. Equip boxes supporting fixtures designed to accept fixture studs with 3/8-inch stud (galvanized malleable iron) inserted through back of box and secured by locknut. Boxes not equipped with outlets shall have level metal covers with rust-resisting screws.
- KK. Do not mount junction boxes above inaccessible ceilings or in inaccessible spaces. Do not mount junction boxes above ceilings accessible only by removing light fixture, mechanical equipment or other devices. At inaccessible spaces use junction box furnished with light fixture or light fixture wiring compartment UL listed for through wiring.
- LL. No more than 12 conduits containing branch circuits may be installed in any junction or pull box.
- MM. All junction boxes shall be protected from building finish painters' over spray and from fire proofing overspray. Remove protective coverings when painting and fire proofing are complete.
- NN. Bond equipment grounding conductor to all junction and pull boxes.
- OO. Do not mount boxes or conduit bodies on walls directly above electrical panels or switchgear located next to walls.
- PP. Do not mount boxes or conduit bodies within 18 inches of outside edges of roof access openings.
- QQ. Box extenders or plaster rings shall not be used to increase the Code mandated cable capacity of a box. Provide proper size box.

### 3.2 ADJUSTING

- A. Adjust flush-mounting outlets to make front flush with finished wall material.
- B. Install knockout closures in unused box openings.

END OF SECTION

## ELECTRICAL BOXES AND FITTINGS

SECTION 26 05 50

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson
- B. 3M (Minnesota Mining Manufacturing)
- C. Hilti
- D. Specified Technologies, Inc.
- E. Metacaulk

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

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SECTION 26 24 25

ENCLOSED SWITCHES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Safety and disconnect switch work where required, scheduled, indicated, specified, and required. For switches indicated or rated above 1,200 Amps, provide switchboard construction as specified for switchboards.
- B. UL Approved: Safety and disconnect switches shall have UL approval and the UL label.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Schneider Electric - Square D
- B. ABB-General Electric Co.
- C. Siemens
- D. Eaton

2.2 ENCLOSED SWITCHES

- A. General: Provide heavy duty type, dead-front, sheet steel enclosed, surface-mounted safety switches of the type and size indicated. Safety switches shall be rated for the voltage of the circuit where they are installed. Safety switches used as motor disconnects shall be rated for the motor horse power served.
- B. The overcurrent protective device short circuit, coordination and arch flash studies performed by the overcurrent protective device manufacturer shall be used by the respective switchgear vendor(s) to select appropriate equipment, switchgear, and overcurrent protective device characteristics such as but not limited to: equipment bracing, AIC rating, circuit breaker frame size and trip settings, and fuse type/class. The appropriate equipment suitable and required by the studies for code compliance shall be included with the submittal data for review and provided at no additional cost to the Owner. The appropriate equipment recommended by the studies for enhanced selective coordination or enhanced arc flash energy reduction beyond code compliance shall be included with the submittal data for review and consideration purposes by the engineer.
- C. Switch Mechanism:
  - 1. Safety switches shall be quick-make, quick-break type with permanently attached arc suppressor. Constructed so that switch blades are visible in the OFF position with the door open. The operating handle shall be an integral part of the box, not the cover. Switch shall have provision to padlock in the OFF position. Safety switches shall have a cover interlock to prevent unauthorized opening of the switch door when the switch mechanism is in the ON position, or closing of the switch mechanism when the switch door is open.
  - 2. Cover interlock shall have an override mechanism to permit switch inspection by authorized personnel. Current-carrying parts shall be constructed of high conductivity copper with silver-plated switch contacts. Lugs shall be suitable for copper conductors and front removable.
- D. Neutral: Provide safety switches with number of switched poles indicated. Where a neutral is present in the circuit, provide a solid neutral with the safety switch. Where a ground conductor is present in the circuit, provide a separate solid ground with the safety switch.
- E. Auxiliary Contacts: Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch.

ENCLOSED SWITCHES

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## 2.3 ENCLOSED SWITCHES WITH OVERCURRENT AND/OR GROUND FAULT PROTECTION

- A. Overcurrent protective devices 1,200 Amps and below:
  - 1. Where switch is intended as a building service disconnect provide solid neutral and ground bus and service entrance SE rating.
  - 2. Molded case circuit breakers:
    - a. Greater than 800 Amp: Solid state true RMS sensing with adjustable: current, I<sup>2</sup>t settings, ground fault (where required), instantaneous trip, and short time trip; 80-percent continuous current rating.
    - b. 800 Amp and smaller: Solid state true RMS sensing with fixed current setting by rating plug or dial. Breaker shall have adjustable instantaneous trip function with short time tracking.
    - c. 1,200 Amp and larger frame circuit breakers regardless of trip shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
  - 3. Fusible switches:
    - a. Quick-make, quick-break units utilizing the double-break principle of circuit interrupting to minimize arcing and pitting and shall conform to the ratings shown.
    - b. Individual door over the front, equipped with a voidable interlock that prevents the door from being opened when the switch is in the ON position unless the interlock is purposely defeated by activation of the voiding mechanism. All switches shall have externally operated handles.
    - c. 600 Amps and below equipped for Class J fuses.
    - d. 601 Amps and above shall be equipped for Class R or L fuses.
    - e. When required by the latest edition of the NEC or the AHJ, 1,200 Amp fused switches regardless of fuse size installed shall have Energy Reducing Maintenance System switch with local status indicator (ERMS).
- B. Ground Fault Interrupter (GFI) protection: Where shown or required, ground fault protection shall be achieved with adjustable pickup for ground fault currents, field-adjustable from 200 amperes and instantaneous to 60 cycle time delay. The ground fault protection system shall include necessary current sensors, internal wiring, and relays to coordinate opening the monitored faulted circuits.
  - 1. Ground fault protection shall be set at minimum setting for both current and time during construction. The manufacturer shall include in the submittal data the minimum setting of the device and the recommended setting for normal building operation.
  - 2. The ground fault system shall be factory-tested before shipment as specified:
    - a. The manufacturer shall provide a factory ground fault protection system test for circuit testing and verification of tripping characteristics. The manufacturer shall pass predetermined values of current through the sensors and measure the tripping time for each phase and neutral. The measured time-current relationships shall be compared to the trip-characteristic curves. If the ground fault device trips outside the range of values indicated on the curve, the ground fault device shall be replaced or recalibrated.
    - b. Relays, electrically operated switches, shunt-trip switches, circuit breakers, and similar items shall have proper voltages applied to their circuits and satisfactory operation demonstrated.
    - c. Upon completion of the factory ground fault protection system test, the current and time on each ground fault device shall be set to minimum values.

## 2.4 ENCLOSURES

- A. Enclosures in indoor locations shall be NEMA 1 unless shown otherwise.
- B. Enclosures in exterior locations shall be NEMA 4X stainless steel.
- C. Enclosures at kitchen and food preparation locations, exterior kitchen supply and exhaust fans, hose down areas, cooling towers, in greenhouses, and in other corrosive areas shall be NEMA 4X, stainless steel.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. General: Install safety and disconnect switches where required or indicated, in accordance with the manufacturer's written instructions, requirements of the NEC, NECA Standard of Installation, and industry practices. Provide fuse identification label when fused switches are required showing type and size inside door of each switch. Include devices in coordination study to indicate overcurrent devices will selectively coordinate.
- B. Location: Provide safety switches within 50' and in sight of motor served. There shall be minimum code required clearance in front of safety switch and a clear path in which to access the switch. (i.e.: not having to walk and/or stand on obstacles such as drain pans on floor to service).
- C. Supports: Provide all safety and disconnect switches with galvanized angle or other supports where mounting on wall or other rigid surface is impractical. Switches shall not be supported by conduit alone. Where safety and disconnect switches are mounted on equipment served, the switch shall not inhibit removal of service panels or interfere with access areas, not void the warranty of the equipment served. Provide mounting hardware that will allow removal of safety and disconnect switches with common work tools. Do not utilize drive pin anchors through enclosure.
- D. Ground Fault Interrupter (GFI) test and settings: Where adjustable ground fault interrupter settings are provided or required, after completion of construction and before final acceptance testing, the ground fault protection system shall be field-tested and reset to the manufacturer's settings for both current and time by a representative of the manufacturer's engineering service department. After the test, set ground fault to 50-percent of the overcurrent device rating.
- E. Safety and Disconnect Switches: Install disconnect switches for motor-driven equipment, appliances, motors, and motor controllers within sight of the controller position unless indicated otherwise.
- F. Variable Frequency Drive (VFD) Warning Plaque: Provide VFD warning plaque at safety disconnect switches which are located down-stream of VFDs. Secure plaque to disconnect switch or immediately adjacent to disconnect switch with fasteners. Plaque shall be Yellow-White-Yellow 3-layer plastic laminated engraved with: "WARNING" (1/2 Inch Letters). "TURN OFF VFD BEFORE OPENING THIS SWITCH FOR MAINTENANCE." (1/4 inch letters).
- G. Provide disconnect switch for electric duct heaters.
- H. Where disconnect switch is used or indicated as the utility service building disconnect, provide main bonding jumper and neutral to ground bond connected to the building's grounding system. Do not bond neutral to ground when there is a neutral to ground bond upstream from the same derived neutral system serving the disconnect switch.
- I. Disconnect switches related to all smoke control fans shall have auxiliary contacts for fire alarm system monitoring of the position of the disconnect switch, coordinate with Division 28. Coordinate with fire detection and alarm contractor for the fire alarm and detection system to monitor all disconnect switches open/closed position that serve the smoke control system. All fire alarm and control wiring directly related to the monitoring of the supply power disconnect switches and control of the smoke control fans shall be installed in conduit.

### 3.2 TESTING

- A. General: Before energizing, check for continuity of circuits and short circuits.
- B. Provide thermal infrared scan of the enclosed switches rated 200 Amps or larger under full load prior to testing / maintenance and modifications and of the modified and new switchboard sections after construction as directed and witnessed by Owner. Make corrections as needed as soon as possible as directed by the Owner. Repeat the scan at the 11-month prior to closeout, and make corrections prior to closeout. Provide digital video documentation with test results for comparison between prior condition and post construction modifications and future tests.

END OF SECTION

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SECTION 26 24 30

FUSES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Fuse work as shown and scheduled, and as specified.
- B. Types: Fuses required for the project include the following:
  - 1. 250 volt current limiting fuses
  - 2. 600 volt current limiting fuses

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by Bussman or Littlefuse.

2.2 CURRENT LIMITING FUSES - 600 VOLTS AND LESS

- A. General: Provide 200,000 amperes interrupting capacity (AIC) current-limiting fuses of the current ratings shown and voltage rating equal to or greater than the voltage at the point of application.
- B. Types:
  - 1. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 600 amperes or less, shall be UL Class RK1 or Class J, time delay fuses, Bussman LPS-RK (600V) LPJ-SP (600V), LPN-RK (250V).
  - 2. Fuses in circuits supplying individual motors, groups of motors, or loads including motors, 601 to 4000 amperes, shall be UL Class L time delay fuses, Bussman KRPC "HI-CAP".
  - 3. Fuses in circuits supplying other than motor loads, 600 amperes or less, shall be UL Class RK1, time delay fuses, Bussman LPS-RK (600V), LPN-RK (250V).
  - 4. Fuses supplying surge protection devices (SPD) shall be surge rated for use with SPD devices.

2.3 SPARE FUSES

- A. General: Provide spare fuses in the amount of 10% of each type and size installed, but not less than 3 spares of a specific size and type. Deliver to the Owner at the time of project acceptance. Fuses shall be encased in a labeled steel enclosure with padlock provision, to be wall mounted where directed.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. General: Install fuses in fuse holders immediately before energizing of the circuit where the fuses are installed. Fuses shall not be installed and shipped with equipment.
- B. Labels: Place fuse identification labels, showing fuse size and type installed, inside the cover of each switch.

END OF SECTION

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SECTION 26 27 73

LINE VOLTAGE WIRING DEVICES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide wiring device work as shown, scheduled, indicated, and specified. Low voltage and/or digital control switches required for lighting controls and lighting control systems shall be as specified and required for the low voltage and / or digital control lighting system. Refer to drawings or other specification sections for low voltage / digital lighting control systems. Cover plates for lighting control systems shall be as specified in this section unless specifically required otherwise by the low voltage / digital control device bulkhead or form factor.

1.2 QUALITY ASSURANCE

- A. UL Label: Wiring devices shall be UL labeled.
- B. NEMA Standard WD1 and WD6.
- C. Fed. Spec. WC596, W-S-896

1.3 SUBMITTALS

- A. Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect/Engineer/Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy of the specification section with the product data.
- B. Submit a sample of each style and color of 120-Volt duplex receptacle and each 120/277- Volt switch with related cover plate. Attach plate to wiring device and label back side of plate with job description with permanent black marker.
- C. Submit manufacturer's product data sheet for each style of device and plate on the project.
- D. Submit drawings of plans, elevation and sections of receptacles and outlets in casework, cabinetwork and built-in place furniture. Coordinate dimensions with millwork shop drawings and related architectural drawing series.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Toggle switches, straight blade and twist lock devices, interior cover plates:
  - 1. Leviton
  - 2. Hubbell
  - 3. Pass and Seymour
  - 4. Eaton
- B. Dimming
  - 1. Leviton
  - 2. Lutron

2.2 WIRING DEVICE COLOR

- A. Device color shall be gray except 20A, 125V receptacles and toggle wall switches which are directly supplied from an emergency source shall be red, and heavy duty 30 Amp and larger simplex devices which shall be black in color where the building standard color is not available. Provide equivalent hospital grade devices where red is not available in grade specified. Verify with

LINE VOLTAGE WIRING DEVICES

Owner / Architect prior to submitting for approval. Color change kits as required for dimming switches. Low voltage lighting control devices specified elsewhere shall match the line voltage wiring device color specified in this section.

## 2.3 RECEPTACLES

- A. Industrial or hospital grade tamper resistant smooth face duplex receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mounting straps, locking plug-tail or back and side wired with screw type terminals, NEMA indicated, (X=color designation).
1. 20A, 125V duplex NEMA #5-20R: Leviton #5362-SGX
  2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #5362-IGX
  3. 20A, 125V ground fault circuit interruption (GFCI) NEMA #5-20R weather and tamper resistant: Leviton #G5362-WTX
  4. 20A, 125V weather resistant (WR), tamper resistant: Leviton #TWR20-GY
  5. 20A, 125V plug load control, split circuit marked for "controlled", tamper resistant: Leviton #TDR20-S1G
  6. 15A, with 20A feed-through, NEMA #5-15R, 125V duplex, arc fault (AFCI), tamper resistant: Leviton #AFTR1-HGX
- B. Heavy-Duty Simplex: Single heavy-duty type receptacles, with green hexagonal equipment ground screw, with metal mounting straps, back or side wiring, black molded phenolic compound.
1. 15-60A, 125-250V, straight blade, NEMA configuration as indicated or as required by Owner.
  2. 15-50A, 125-480V, twist lock, NEMA configuration as indicated or as required by Owner.
- C. Hospital grade receptacles, 2 pole, 3 wire grounding, with ground connection and poles internally connected to mounting yoke, with metal mount straps, locking plug-tail or back and side wired with screw type terminals, molded phenolic compound, NEMA configuration indicated.
1. 20A, 125V grounded duplex NEMA #5-20R: Leviton #8300-X
  2. 20A, 125V isolated ground duplex NEMA #5-20R: Leviton #8300-LIG (orange)
  3. 20A, 125V ground fault circuit interruption (GFCI) with indicator light: Leviton NEMA 5-20R-8898-HGX
  4. 20A/125V Tamper Resistant Duplex NEMA 5-20R: Leviton 8300-SGX
- D. USB 2-port charger / tamper-resistant with 125-Volt receptacles:
1. USB type A/C, 1 type A and 1 type C port, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5833-HGX
  2. USB A, 2 type A ports, 5.1A 5.0VDC charging. 20A, 125V, NEMA 5-20R: Leviton #T5832-HGX
- E. USB 4-port charger:
1. USB type A+C, 2 type A ports and 2 type C ports. 5.0A 5.0VDC charging. Hubbell #USB4ACX.
  2. USB type A, 4 type A ports. 5.0A 5.0VDC charging. Hubbell #USB4X.

## 2.4 WALL SWITCHES

- A. Toggle: Industrial grade flush toggle switches, with mounting yoke insulated from mechanism, equipped with plaster ears, switch handle, back and side-wired screw terminals.
1. Single-pole, 120/277V, 20A switch: Leviton #1221-2X
  2. Double pole 120/277V, 20A switch: Leviton #1222-2X
  3. Three-way, 120/277V, 20A switch: Leviton #1223-2X
  4. Four-way, 120/277V, 20A switch: Leviton #1224-2G
  5. Pilot light single-pole, 120/277V, 20A switch: Leviton #1221-PL
  6. Momentary, 120/277V, 20A, single-pole double throw, center off: Hubbell only, #HBL 1557G
- B. Toggle key operated switch (verify manufacture and key type with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Hubbell HBL #1221GY
  2. Two-pole, 120/277, 20A key operated, Hubbell HBL #1222GY
  3. Three-way, 120/277V, 20A key operated switch: Hubbell HBL #1223GY
  4. Four-way, 120/277V, 20A key operated switch: Hubbell HBL #1224GY

## LINE VOLTAGE WIRING DEVICES



5. Momentary, single pole double throw, center off, 20A key switch: Hubbell #HBL 1557LG.
6. Key: Hubbell #HBL 1209. Key switches shall be keyed alike to match the Owner's standard key system. Coordinate with Owner.

- B. Rotary key operated switch (verify manufacturer and keying with Owner prior to construction).
1. Single-pole, 120/277V, 20A key operated switch: Leviton #1221-KL
  2. Two-pole, 120/277, 20A key operated, Leviton #1222-2KL.
  3. Three-way, 120/277V, 20A key operated switch: Leviton #1223-3KL
  4. Four-way, 120/277V, 20A key operated switch: Leviton #1224-4KL
  5. Key switches shall be all keyed alike to match the Owner's standard key system. Leviton #WS-35 or as otherwise directed by Owner.

## 2.5 WALL DIMMERS

- A. Wall Box Dimmers: Self-contained, wall box mounted, linear slide square law dimmers with ON/OFF switch. Dimmers shall operate continuously at rated load in an ambient temperature up to 40°C and an input of 100 to 277V. Heat sink fins may be removed only as approved by Owner / Engineer for narrow ganging after applying de-rating.
1. Single-pole, 120/277V, 1000/2308 Watt incandescent / magnetic low voltage: Leviton #AWSMT-MBW.
  2. Single-pole, 120/277V, 1500/3463 Watt incandescent / magnetic low voltage, 2-gang heat sink: Leviton #AWSMT-MCW.
  3. Single-pole, 120/277V, 1920/4432-Watt LED / fluorescent 0-10V dc, 75 mA current sink: Leviton #AWSMT-7DW.
  4. Three, four- or five-way remote switch: Leviton #AWSRT-00W.
  5. Color change kit as required.

## 2.6 GFCI – GROUND FAULT CIRCUIT INTERRUPTER, BLANK FACE

- A. 20A, 125V, GFCI, switch rated, blank face feed through, Hubbell #GGBF20GYL, gray finish, stainless steel cover plate black laser engraved with device protected, (example: DRINKING FOUNTAIN GFCI).

## 2.7 INTERIOR WALL COVER PLATES AND FASTENERS

- A. Type 302 non-magnetic stainless-steel with satin finish (also required for wall box device cover plates for low voltage and digital lighting controls specified elsewhere).
- B. Cover plate laser plate engraving for device identification (other than low voltage lighting controls).
1. Provide laser cover plate engraving with black filling for all wiring devices indicating panelboard name, circuit, and voltage.
  2. Wiring devices connected to emergency/stand-by generator or inverter shall include the word "EMERGENCY".
  3. Text orientation shall be upright, readable from left to right when cover plate is installed.
  4. Remotely located lighting switches shall also indicate the room or area and zone controlled by each switch. Coordinate specific wording with Owner/Architect.
  5. Blank face GFCI cover plates shall also intuitively indicate the load or equipment served, device, or area protected downstream ("EDF" for drinking fountains, "RM RECEPTS", "HOOD RECEPTS", "VENDING", "REFRIG", etc.) For other loads, Owner/Architect shall determine name plate wording.

## 2.8 EXTERIOR COVER PLATES

- A. Thomas & Betts CK Series, cast aluminum standard depth, locking mount, while-in-use, wet location, universal configuration.
1. Vertical mount receptacle: #CKSUV
  2. Horizontal mount receptacle: #CKMU
  3. Two-gang: #2CKU
  4. 30-60 Amp Devices: #CKLSUV

## 2.9 CORD REELS AND DROP CORDS

### LINE VOLTAGE WIRING DEVICES

- A. Cord Reels:
    - 1. Lighted cord reels: Industrial grade, LED hand Lamp only, 125V, 45-foot 16/3 SJEO cord, white finish, LED hand lamp. Hubbell #HBLI45163LED with #HBL340PB pivot base.
    - 2. 20 Amp (2) duplex receptacle cord reels: Industrial grade, 125V, (2) 20A duplex receptacles, GFCI protection, 45-foot 12/3 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45123GF220 with #HBLI340PB pivot base.
    - 3. 30 Amp receptacle cord reels: Industrial grade, 125/250V, 30A, 45-foot 10/4 SJO cord, white finish, yellow outlet box. Hubbell #HBLI45104 with #HBLI340PB pivot base. 30 Amp NEMA receptacle termination as required by Owner.
    - 4. 50 Amp receptacle cord reels: Industrial grade, NEMA 4 wet location, 600V, 55A, 50-foot 6/4 SOOW cord, yellow finish, self-retracting, with NEMA 50-Amp maximum receptacle termination as required by Owner. KH-Industries RTMH4L-WW-K6K.
    - 5. Recessed enclosure for 20 and 30-Amp cord reels recessed above T-grid drop ceilings: Hubbell #HBLIPRBOX recessed cord reel enclosure, white finish, plenum rated.
  - B. Drop cord receptacles:
    - 1. 20A, 125V, 25-feet 600 VAC, 3-conductor 12 AWG SOOW cable, twist lock plug, two 125V, 20A duplex WR GFCI outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP4DD-520-B12F-520.
    - 2. 20A, 125/250V, 25-feet 600 VAC, 4-conductor 12AWG SOOW cable, twist lock plug, four 125/250V NEMA L1420P outlets, safety yellow rubber outlet box, mesh strain relief cord grips. KH Industries #PP7DD-520-B12F-L1420.
    - 3. 30-60 Amp, voltage, NEMA plug/receptacle as required by Owner, SOOW cable, number of conductors and length as required, mesh strain relief cord grips.
- 2.10 FIRST RESPONDER EMERGENCY REMOTE POWER OFF (FREPO) STATION
- A. Knox Company Remote Power Rapid Access 4500 Series Shutdown Station
    - 1. Recessed mount for public spaces and new construction, surface mount for when mounted to equipment or existing construction.
    - 2. Single lock keyed for local Fire Department/AHJ, verify configuration and keying with Knox Company.
    - 3. Red Finish
    - 4. Tamper alert for integration with building security system.

## PART 3 - EXECUTION

### 3.1 INSTALLATION

- A. Cover plates for receptacles and toggle switches shall be of the same manufacturer throughout unless otherwise noted.
  - 1. Key switches and keys shall be as specified and also as approved by Owner.
  - 2. Submit samples for each specified toggle switch and duplex receptacle color to Architect.
- B. Install wiring devices where shown and as required, in accordance with manufacturer's written instructions, requirements of NEC, and in accordance with industry practices. Do not install devices until wall construction and wiring is completed.
- C. Install receptacles and switches only in electrical boxes that are clean, free from building materials, debris, and similar matter.
- D. Install wiring devices plumb and aligned in the plane of the wall, floor, ceiling or equipment rack.
- E. Install switches in boxes on the strike side of doors as hung. Install so the up position will close the circuit or will be the highest level of illumination. Where more than one switch is in the same location, install switches in a multi-gang box with a single cover plate.
- F. Provide a cover plate for every wiring device and blank cover plates for unused rough-in-only boxes that matches the building standard. Fasten all plates outdoors with type 302 Allen Head "tamper-proof" screws.
- G. Mounting heights of all wiring devices shall comply with local accessibility standards and local codes, except where wiring devices are indicated for special purpose and access is only required by maintenance or service personnel.

- H. Refer to Architectural drawing and elevations, etc. for exact location of wiring devices. Coordinate location of all wiring devices with other trades, specialty items, and millwork and resolve all conflicts prior to rough-in. Field coordinate exact mounting location with all trades to avoid and resolve conflicts during construction.
- I. Locate receptacles for electric drinking fountains/coolers and bottle fill stations below equipment so that the receptacle is accessible and concealed as much as practical from public view by the equipment open cowling so that the receptacle remain readily accessible. For dual level basin equipment, locate receptacle under the upper basin.
- J. Provide convenience outlet receptacle within 25-feet of all new electrically operated mechanical equipment.
- K. Where exterior receptacles are intended for continuous use, mount in horizontal position with while in use cover plate. (Exterior electric drinking fountains, ice makers, ice storage bins, landscape lighting low voltage transformers, seasonal decorative lighting, etc.)
- L. Install wall box dimmers to achieve full rating specified after de-rating for ganging as recommended by manufacturer.
- M. Do not share neutral conductor on load side of dimming switches.
- N. Install receptacles with grounding pole down, except in any of the following conditions where the grounding pole shall be installed in the up position: healthcare occupancies, if required by local AHJ, if required by Owner's construction standards or if directed by Owner or Architect. If installed horizontally, install with neutral pole on top.
- O. Connect wiring device grounding terminal to branch circuit equipment grounding conductor.
- P. Provide pigtail to each receptacle and each switch. Neutral and phase conductors shall be installed using side or rear entry lugs only. Do not wrap conductors around screw terminals. Tighten all screws and lugs as recommended by manufacturer.
- Q. All receptacles and switches shall have a minimum of two wraps of Scotch 33 or equivalent tape around terminal screws.
- R. Provide toggle switch within sight of all trap primers, circulation pumps, 120-Volt motors and motorized equipment to serve as the equipment disconnect switch.
- S. Mount cord reels and cord reel recessed enclosures to structure with galvanized steel struts and as recommended by manufacturer. Field verify exact location of cord reels with Owner/Architect. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc. when cord reel is extended and retracted. Set ball stop as directed by Owner / Architect. Provide hand lamp only type cord reels in commercial / educational automotive garages with classified (hazardous) locations. Provide local toggle switch at standard switch height for hand lamp only cord reels.
- T. Mount drop cord suspension hook or j-box to structure to support the cord's weight and additional normal use pulling tension and as recommended by manufacturer. Use cable grips, either with cord grip hanging hook at open ceilings or with chrome plated escutcheon cover plate mounted to recessed j-box at finished ceilings. Field verify exact location, drop height, and NEMA outlet configuration of drop cords with Owner/Architect. Provide weatherproof receptacle cap or covers if located in wet location. Mounting location shall avoid conflicts with piping, light fixtures and ductwork, etc.

### 3.2 GROUND FAULT PROTECTION FOR PERSONELL

- A. When GFCI personnel protection receptacles are not commercially available or cannot be installed at a readily accessible location or indicated otherwise on the drawings, GFCI personnel protection shall be provided by a remote blank face GFCI wiring device or by an up-stream GFCI receptacle that also provides downstream GFCI protection and located in a readily accessible location. When branch circuit breaker device with integral GFCI protection is required or specified, it shall be within

the manufacture's recommended distance limitations of the connected receptacle(s) or load(s) for proper GFCI personnel protection at the farthest outlet.

- B. GFCI personal protection locations include but are not limited to the following:
1. For other than dwelling units: All single phase 125-250-Volt (150-Volts to ground or less) receptacles 50-Amperes or less, and all three phase 125-250-Volt (150-Volts to ground or less) receptacles 100-Ampres or less in the locations indicated below.
  2. Dwelling units: All single phase 125-250-Volt receptacles installed in the following locations indicated below.
  3. Provide personnel GFCI protection as indicated above in the following locations and all additional locations as required by the NEC.
    - a. Outdoors (with exceptions for not readily accessible receptacles with dedicated branch circuits for snow melting, deicing, pipeline/vessel heat receptacles. Provide these loads with 30mA EGFI circuit breaker protection).
    - b. Bathrooms/toilets/restrooms
    - c. Janitors/custodial closets and mop sinks.
    - d. Laundry areas
    - e. Parking structures, service garages, garages and accessory buildings
    - f. Basements, crawl spaces (including 120-Volt lighting)
    - g. Within 6-feet of all water sources including sinks, mop-sinks, lavatories, bathtubs, shower stalls, faucets, eye wash stations, emergency shower stations
    - h. Indoor damp and wet locations
    - i. Locker rooms
    - j. Indoor swimming pools and natatoriums areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
    - k. Non-dwelling unit therapeutic tubs/pools/whirlpool areas and adjacent corridor/hall convenience receptacle outlets located within 25-feet of all access doors.
    - l. Receptacles serving dwelling unit kitchen counter tops
    - m. Vending machines
    - n. Elevators, dumb waiters, escalators, moving sidewalks: receptacles in pits, hoist ways, well ways or those mounted on the cars of elevators and dumb waiters.
    - o. Electric vehicle charging equipment.
    - p. All receptacles serving kitchen or food preparation counter tops.
    - q. Automotive vacuum machines
    - r. Drinking water fountains/coolers and bottle fill stations
    - s. Corded high-pressure spray washing machines
    - t. Tire inflation machines
    - u. Dish washers
    - v. Receptacles at end of cord reels or drop cords.
    - w. Boat houses, boat hoist, and all pier/dock receptacles and lighting (excludes shore power that requires GFPE).
    - x. Central plant, mechanical rooms and electrical rooms
    - y. Wood, metal, or other material fabrication or vocational training shops.
    - z. Receptacles that serve educational science and science prep room counter tops.
- C. Where a GFCI protected receptacle outlet is required or indicated behind vending machine, refrigerators or other equipment, provide remote GFCI blank face in same room as protected receptacle and at a readily accessible location with standard receptacle outlet behind equipment. Refrigerators shall be GFCI protected only where located within 6-feet of power cord distance from the edge of a sink to the surface of the refrigerator.
- D. Unless indicated otherwise, locate blank face GFCI device near light switches at same height as light switches or ganged with the light switch. Provide GFCI protection for all receptacle outlets located below 42-inches in all infant through 2-year old day care and similar areas designated for occupancy by infant through 2-year old day care occupants so the GFCI device can easily be intentionally tripped or tested and reset.
- E. Provide branch circuit breaker 30mA (EDP) or 100mA (EPE) equipment protection for utilization equipment as required by the NEC and where indicated on the drawings.

### 3.3 FIRST RESPONDER REMOTE EMERGENCY POWER OFF (FREPO) STATION

- A. Provide Knox Company first responder remote emergency power off (FREPO) stations as indicated and/or where required by local AHJ. Mounting locations shall be as directed by the local AHJ and exact locations coordinated with the Architect. FREPOs shall be circuited only to shunt trip or shut-down control circuiting. FREPOs shall be recessed mounted in public locations and in all new construction when attached to building construction. Provide surface mount FREPOs when mounted to equipment or existing construction.
- B. Integrate the FREPOs to shut-down the building non-emergency and non-legally required power sources which include the main electrical utility service disconnect circuit breaker(s), other than non-life safety or non-legally required distribution scale UPS equipment, and non-life safety or non-legally required local power generation equipment.
- C. Provide FREPOs for fire pump, life safety, and legally required electrical generation equipment only when required by the AHJ. When required by the AHJ, fire pump, life safety, and legally required power generation and/or stored energy power supply equipment shall each have separate dedicated FREPOs that shut down only their associated power generation/stored energy equipment. FREPOs for emergency, and legally required systems shall have minimal 25-foot physical separation from the building main utility service FREPOs and clearly labeled with the equipment that they will shut down. FREPOs for fire pumps shall have minimal 25-foot physical separation from the any other FREPOs and from the building main utility service disconnect and clearly labeled with the equipment that it will shut down.
- D. Integrate the FREPOs tamper switch with the building security or building management control system (BMCS) as directed by Owner.

#### 3.4 TESTING

- A. Before energizing, check for continuity of circuits, short circuits, and grounding connections.
- B. After energizing, check wiring devices to demonstrate proper operation and receptacles for correct polarization, voltage and phase orientation if intended 3-phase equipment is phase orientation dependent for proper motor rotation or operation.
- C. Test each individual GFCI receptacle and all downstream receptacles protected by an upstream GFCI device with simulated ground fault tester, make corrections as necessary.
- D. Operate each wall switch with circuit energized and verify proper operation.

END OF SECTION

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SECTION 26 51 13  
LIGHTING FIXTURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Work Included: Lighting fixture work is as shown, scheduled and specified.
- B. Applications: The applications of lighting fixtures required for the project include the following:
  - 1. General lighting
  - 2. Emergency lighting
  - 3. Outdoor area lighting

1.2 QUALITY ASSURANCE

- A. Provide interior building LED fixtures that comply with the Design Lights Consortium (DLC) standards and are DLC or DLC Premium listed as a Qualifying Product at time of proposal submittal date.
- B. UL Standards: Lighting fixtures shall conform to applicable UL standards, and be UL or ETL labeled.
- C. Light fixtures shall conform to the requirements of NFPA 101, and 70 (NEC).

1.3 SUBMITTALS

- A. Submit product data for light fixtures, and emergency lighting equipment, including generator transfer devices.
- B. Specification Compliance Review: Mark up a complete copy of the specification section for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer / Owner (Does Not Comply, Explanation:) Do not submit an outline form of compliance, submit a complete copy with the product data.
- C. Submittal data shall include luminaire efficiency parameters.
- D. Submittal data for exterior luminaires shall include IESNA BUG ratings, backlight, uplight, and glare ratings of each unique luminaire for the orientation and tile specified. Indicate total absolute lumens per luminaire and absolute lumens emitted above horizontal based by each luminaire for the orientation and tile specified.

1.4 WARRANTY

- A. Provide 5-year warranty on all light fixtures, including internal or remote LED drivers, all other electrical internal electrical or electronic components except for emergency battery packs or emergency load control device relays. Refer to other specific component warranty requirements below.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers: Provide products produced by manufacturers shown or scheduled for each type of lighting fixture. Refer to drawings for additional approved manufacturers.
  - 1. Light fixtures:
    - US LED
    - Extra Light
    - Acuity

- Hubbell
- Signify
- Cooper Lighting Solutions
- Pinnacle
- HE Williams
- GE Current
- LSI
- 2. LED Drivers:
  - Philips
  - Osram Optotronic
  - Eldo LED
- 3. Emergency Battery Packs with self-testing drivers/inverters:
  - Bodine
  - Chloride
  - Lithonia
  - Dual Lite
  - IOTA
- 4. Emergency Generator/Inverter Load Control Bypass Relay (ELC); UL924 listed and 0-10Vdc compatible:
  - Bodine
- 5. Emergency Generator / Inverter Branch Circuit Transfer Switch, UL 1008 listed and 0-10Vdc compatible:
  - Bodine GTD20A

## 2.2 MATERIALS AND COMPONENTS

- A. General: Provide lighting fixtures of the size, type, and rating indicated, with all accessories for a complete aesthetic installation.
- B. Fixture Types:
  - 1. General:
    - a. LED Lay-in edge lit or back flat panel / troffer fixtures: Opaque, edge or back lighted, 4000 Kelvin color temperature. 0-10 Vdc dimmable, L70: 60,000 minimum hours.
    - b. Safety chains and wire guards at fixtures in mechanical and electrical rooms, and high abuse areas. Provide safety chains only for gymnasium fixtures which shall be inherently vandal proof, no wire guards.
    - c. Fixtures located outdoors, in interior unconditioned spaces, and in wet locations shall be of aluminum construction.
    - d. Fixtures with door frames shall be of aluminum construction, white finish where located in kitchens, food prep areas, toilets, restrooms, locker rooms, dressing rooms, showers, and unconditioned spaces.
    - e. DLC, DLC Premium or Energy Star qualified unless specified otherwise.
    - f. Outdoor fixtures shall include a discrete / replaceable surge suppression device in addition to the surge suppression incorporated in the LED driver.
    - g. Operating temperature rating shall be between -40 degrees F and 120 degrees F.
    - i. Color Rendering Index (CRI):  $\geq 80$  Indoor;  $\geq 65$  Outdoor
    - j. The manufacturer shall have performed JEDEC (Joint Electron Devices Engineering Council) reliability tests on the LEDs as follows: High Temperature Operating Life (HTOL), Room Temperature Operating Life (RTOL), Low Temperature Operating Life (LTOL), Powered Temperature Cycle (PTMCL), Non-Operating Thermal Shock (TMSK), Mechanical Shock Variable Vibration Frequency, and Solder Heat Resistance (SHR).
  - 2. Downlight Fixtures: Provide recessed downlight fixtures with trim rings compatible with the ceiling material where fixture is to be installed.
  - 3. LED Exit Signs: Provide red lettering. The exit lighting fixtures shall meet the requirements of Federal, State, and Local Codes.
    - a. Gymnasiums, locker rooms, athletic/PE wing and associated corridors, black box theaters, auditorium stages, cafeteriums and kitchens: Vandal resistant, wet location cast aluminum with polycarbonate protective cover exit signs, Lithonia Extreme Series.
  - 4. Emergency Lighting Units: Lead Calcium batteries with self-diagnostics. Provide full light



- output at 90 minutes of battery operation. LED lamps.
5. Gymnasium light fixtures, glass or acrylic refractors or lenses, round profile, single point swivel pendant or hook mounting, designed to be vandal proof without the need for wire guards, no wire guards.
- C. LED drivers:
1. NEMA 410 compliant for in-rush current.
  2. Starting Temperature: -40° F [-40° C].
  3. Input Voltage: 120 to 480 (±10%) V.
  4. Power Supplies: Class I or II output.
  5. Surge Protection: The system must survive 250 repetitive strikes of "C Low" (C Low: 6kV/1.2 x 50 µs, 10kA/8 x 20 µs) waveforms at 1-minute intervals with less than 10% degradation in clamping voltage. "C Low" waveforms are as defined in IEEE/ASNI C62.41.2-2002, Scenario 1 Location Category C.
  6. Power Factor (PF): ≥ 0.90.
  7. Total Harmonic Distortion (THD): ≤ 20%.
  8. Comply with FCC Title 47 CFR Part 18 Non-consumer RFI/EMI Standards.
  9. Drivers shall be reduction of hazardous substances (ROHS)-compliant.
- D. Voltage: Equipment for use on 120V systems shall be suitable and guaranteed for voltage range of 100V to 130V. Equipment on 277V systems shall be suitable and guaranteed for voltage range of 225V to 290V. Universal voltage equipment shall be suitable and guaranteed for a voltage range of 100V to 290V.
- E. Light fixture housing for exterior use: Provide aluminum or stainless housing. Where stainless steel hardware is used, both male and female fasteners shall be stainless steel.
- F. Emergency LED battery self-testing drivers and inverters; 5-year warranty. Basis of Design:
1. Bodine BSL-ST Series for OEM installation
  2. Bodine BSL310-SI Series for field installation
  3. Bodine ELI-S Series for line voltage sine wave inverter field installation
- G. Emergency Battery Packs – Exit Signs: Nickel Cadmium battery with self- diagnostics; Minimum 3-year non-prorated replacement warranty.
- H. Emergency Generator / Inverter Load Control Device (ELC):
1. 16 Amp minimum ballast / driver load
  2. Compatible with 0-10 Volt dimmer switches
  3. UL 924
  4. Minimum 3-year warranty
  5. Integral or remove test switch.
- I. Emergency Generator / Inverter branch circuit transfer switch:
1. UL 1008
  2. 20 Amp ballast/driver load
  3. 0-10Vdc dimming compatible

### PART 3 - EXECUTION

#### 3.1 INSTALLATION

- A. General: Install lighting fixtures of the types indicated, where shown, and at indicated heights in accordance with the fixture manufacturer's written instructions and industry practices to ensure that the fixtures meet the specifications. Fixtures shall fit the type of ceiling system scheduled.
- B. Standards: Comply with NEMA standards, applicable requirements of NEC pertaining to installation of interior lighting fixtures, and with NECA Standard of Installation.
- C. Attachment: Fasten fixtures to the indicated structural support members of the building. Provide four separate wire supports for recessed ceiling mounted lighting fixtures, one at each corner of fixture. Check to ensure that solid pendant fixtures are plumb. Provide T-bar locking clips on all four sides for lay-in fixtures.

- D. Coordination: Field coordinate and locate lighting fixtures in open ceiling areas including mechanical and electrical rooms so that light is not obstructed by piping, ductwork, etc. Locate light fixtures in front of electrical and mechanical equipment to provide adequate illumination for testing and maintenance. Relocate installed light fixtures as directed by Owner / Architect at no additional cost.
- E. Final adjustment of all aimable exterior light fixtures shall be in coordination with, and to the satisfaction of, the Owner's designated representative. Pre-aim all fixtures prior to scheduled final aiming and adjustment with Architect / Owner. Verify that all rotatable optics are in their proper orientation prior to final aiming.
- F. Provide vandal resistant exit signs without wire guards in all physical education and athletic sports areas, including egress corridors adjacent to these areas, black box theaters, auditorium stages, vocational shops, cafeteriums and kitchens.
- G. Provide exit sign directional arrows as required. Provide a minimum of two and a maximum of 10% spare exit signs to be installed as directed by Architect.
- H. Install in accordance with manufacturers instructions.
- I. Install suspended luminaires using pendants supported from swivel hangers. Provide pendant length required to suspend luminary at indicated height.
- J. Locate recessed ceiling luminaires as indicated on the Architectural reflected ceiling plan.
- K. Install surface mounted luminaires plumb and adjust to align with building lines and with each other. Secure to prohibit movement.
- L. Exposed Grid Ceilings: Support surface mounted luminaires on grid ceiling directly from building structure. Provide auxiliary members spanning ceiling Ts to support surface mounted luminaires. Fasten surface mounted luminaires to ceiling T using bolts, screws, rivets, or suitable clips.
- M. Install recessed luminaires to permit removal from below.
- N. Install recessed luminaires using accessories and fire stopping materials to meet regulatory requirements for fire rating.
- O. Install wall-mounted luminaires at height as directed by Architect.
- P. Install accessories furnished with each luminary.
- Q. Connect luminaires to branch circuit outlets using flexible conduit as specified.
- R. Make wiring connections to branch circuit using building wire with insulation suitable for temperature conditions within luminaires.
- S. Bond products and metal accessories to branch circuit equipment grounding conductor.
- T. Provide emergency transfer devices for light fixtures powered by generator or inverter emergency lighting circuits which are used for normal lighting and to be switched with the switched normal lighting circuit in the same room, corridor or area.
- U. Provide un-switched, constant-hot circuit to all battery powered emergency lighting equipment and emergency load control devices (ELC). Where normal light fixture circuit is switched or contactor controlled, non-switched battery charging or ELC circuit shall originate from same branch circuit breaker as switched lighting circuit.
- V. Provide emergency powered light fixture in front of all electrical switchgear, including but not limited to panelboards, switchboards, motor control centers, low voltage control panels, transfer switches, motor controllers and disconnect switches.
- W. Provide emergency battery operated light fixtures at all transfer switch locations and at all central battery emergency lighting inverters.

LIGHTING FIXTURES

- X. Provide automatic controls for exterior light fixtures. Exterior building mounted light fixtures shall be circuited through lighting contactors. Lighting contactors shall be controlled by the Building Management System. Provide separate lighting contactors for:
  - 1. Parking Lot Lighting
  - 2. Building Mounted Lighting
  - 3. Exterior Signage
- Y. Lighting contactors shall not be installed above ceiling and shall be readily accessible, located in same room as panelboard serving load.
- Z. Wall mounted light fixtures shall be attached to the studs in the walls. Attachment to gypsum board only is not acceptable. Where wall mounted fixtures attach to junction box only, firmly secure junction box to adjoining studs in wall.
- AA. Lighting Fixture Supports:
  - 1. Shall provide support for all of the fixtures. Supports may be anchored to channels of the ceiling construction to the structural slab or to structural members within a partition, or above a suspended ceiling.
  - 2. Shall maintain the fixture positions after cleaning and relamping.
  - 3. Shall support the lighting fixtures without causing the ceiling or partition to deflect.
- BB. Hardware for surface mounting fixtures to suspended ceilings:
  - 1. In addition to being secured to any required outlet box, fixtures shall be bolted to a grid ceiling system at four points spaced near the corners of each fixture. The bolts shall be not less than 1/4 inch secured to channel members attached to and spanning the tops of the ceiling structural grid members. Non-turning studs may be attached to the ceiling structural grid members or spanning channels by special clips designed for the purpose, provided they lock into place and require simple tools for removal.
  - 2. In addition to being secured to any required outlet box, fixtures shall be bolted to ceiling structural members at four points spaced near the corners of each fixture. Pre-positioned 1/4-inch studs or threaded plaster inserts secured to ceiling structural members shall be used to bolt the fixtures to the ceiling. In lieu of the above, 1/4-inch toggle bolts may be used on new or existing ceiling provided the plaster and lath can safely support the fixtures without sagging or cracking.
- CC. Lighting Fixture Supports for aluminum canopies:
  - 1. Light fixtures mounted under aluminum canopies shall be UL wet location from above listed without a protective ceiling or cover. Light fixture shall not have conduit penetrations or mounting hole penetrations field made in the top of the fixture. Conduit penetration shall be at the end of the fixture only.

### 3.2 TESTING

- A. General: Upon installation of lighting fixtures, and after building circuits are energized, apply electrical energy to demonstrate proper operations of lighting fixtures, emergency lighting, and controls. When possible, correct malfunctioning units at the site, then retest to demonstrate proper operation; otherwise, remove and replace with new units, and proceed with retesting.
- B. Pre-Inspection Tasks: Immediately before final inspection, clean fixtures inside and out, including plastics and glassware, adjust trim to fit adjacent surfaces, replace broken or damaged parts, and lamp and test fixtures for electrical and mechanical operations. Any fixtures, or parts of fixtures that show signs of rust or corrosion at the time of completion, shall be removed, and replaced with protected metal parts.
- C. Final aiming and Adjustment: Aim and adjust aimable and adjustable lighting fixtures for their intended purpose. Re-aim and re-adjust as required to the satisfaction of the Architect / Owner, including nighttime adjustment of exterior lighting in the presence of the Architect / Owner.

END OF SECTION

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SECTION 28 01 00

OPERATION AND MAINTENANCE (O&M) MANUALS OF ELECTRONIC SAFETY AND SECURITY SYSTEMS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Compile Electronic Safety and Security (ESS) product data and related information appropriate for Owner's operation and maintenance of products furnished under Contract. Prepare ESS operating and maintenance data as specified in this Section and as referenced in other sections of specifications.
- B. Instruct Owner's personnel in operation and maintenance of equipment and systems.
- C. Submit three (3) electronic copies, on separate devices (CD, USB Flash Drive, or some type of solid-state storage device), of complete O&M manuals in final form. The submitted manual shall be the system manufacturer's operations manual, supplemented with operations and maintenance instructions custom tailored for the system installed. Electronic documentation shall be provided in a non-proprietary PDF format, without password restrictions.
- D. Hard copies shall be provided upon request of the Owner, Architect, and/or Consultant.
- E. Recorded video of all training sessions shall be included in each copy, of each system's final submitted O&M.
- F. The final submitted manual shall include a sign-in sheet and owner/consultant signed acceptance of all training sessions.

1.2 ELECTRICAL OPERATING AND MAINTENANCE MANUAL SUBMITTAL SCHEDULE

- A. Thirty (30) days after receipt of reviewed submittals bearing the Project Technology Consultant's stamp of acceptance (including re-submittals), submit for review, an electronic copy of the first draft of the System's O&M Manual. This copy shall contain as applicable to the specific system, a minimum of the following:
  - 1. Table of Contents for each element
  - 2. Contractor information
  - 3. All shop drawings, coordination drawings and product data, bearing the Project technology Consultant's stamp of acceptance.
  - 4. All parts and maintenance manuals for items of equipment
  - 5. Warranties (without starting dates)
  - 6. Certifications that have been completed; submit forms and outlines of certifications that have not been completed
  - 7. Operating and maintenance procedures.
  - 8. Form of Owner's Training Program Syllabus (including times and dates)
  - 9. Control operations / equipment wiring diagrams
  - 10. Coordination Drawings
  - 11. Schedule of Low Voltage Wire and Cable
  - 12. Schedule of ESS Equipment
  - 13. Schedule of ESS Field Devices
  - 14. Access Control Door Schedules
  - 15. Video Surveillance Camera Schedules
  - 16. Other required operating and maintenance information that are complete.
  - 17. Cable pathway layout drawings and station map, including through wall and floor penetration locations and sleeve sizes.
- B. Copy will be returned to the Contractor within 15 days with comments for corrections.
- C. Submit the electronic completed manuals (hard copies upon request) in final form to the Project's Technology Consultant.
  - 1. Prior to substantial completion for Owner's use after the Owner accepts facility maintenance.

2. Include all specified data, test reports, drawings, dated warranties, certificates, training videos. along with other materials and information.
- D. The Project's Technology Consultant shall review the manuals for completeness within 15 days.
- E. The Contractor shall be notified of any missing or omitted materials. The Manuals shall be reworked by the Contractor, as required, in the office of the Project's Technology Consultant. The manuals will not be retransmitted.
- F. Electronic and/or hard copies of the accepted manuals shall be delivered to the Owner prior to substantial completion.

## PART 2 - PRODUCTS

### 2.1 BINDERS

- A. Upon the request for hard copies of the O&M manuals, the binders shall consist of the following configuration:
  1. Commercial quality black, 3-ring binders with clear, durable, cleanable plastic covers.
  2. Minimum ring size: 1"; Maximum ring size: 3".
  3. When multiple binders are used, correlate the data into related groupings.
  4. Label contents on spine and face of binder with full size insert. Label under plastic cover.

## PART 3 - EXECUTION

### 3.1 SYSTEM OPERATION AND MAINTENANCE MANUAL

- A. Form for Manuals Submitted in Hard Copy Format:
  1. Prepare data in form of an instructional manual for use by Owner's personnel.
  2. Format:
    - a. Size: 8-1/2" x 11"
    - b. Text: Manufacturer's printed data or neatly typewritten.
  3. Drawings:
    - a. Provide reinforced punched binder tab and bind in text.
    - b. Fold larger drawings to size of text pages.
  4. Provide flyleaf indexed tabs for each separate product or each piece of operating equipment.
  5. Cover: Identify each volume with typed or printed title "Operating and Maintenance Instructions". List:
    - a. Title of Project
    - b. Identity of separate structures as applicable
    - c. Identity of general subject matter covered in the manual.
  6. Binder as specified
- B. Content of Manual:
  1. Neatly typewritten Table of Contents for each volume arranged in systematic order as outlined in the specifications.
    - a. Contractor, name of responsible principal, address and telephone number
    - b. A list of each product required to be included, indexed to content of the volume.
    - c. List with each product, name, address and telephone number of:
      - 1) Subcontractor or installer
      - 2) Maintenance contractor as appropriate
      - 3) Identify area of responsibility of each.
      - 4) Local source of supply for parts and replacement
    - d. Identify each product-by-product name and other identifying symbols as set forth in Contract Documents.
  2. Product Data:
    - a. Include those sheets pertinent to the specific product.
    - b. Annotate each sheet to:
      - 1) Identify specific product or part installed.
      - 2) Identify data applicable to installation.
      - 3) Delete references to inapplicable information.

3. Drawings:
    - a. Supplement product data with drawings as necessary to illustrate:
      - 1) Relations of component parts of equipment and systems
      - 2) Control and flow diagrams
    - b. Coordinate drawings with information in Project Record Documents to assure correct illustration of completed installation.
    - c. Do not use Project Record Documents as maintenance drawings.
  4. Written text as required to supplement product data for the particular installation:
    - a. Organize in consistent format under separate headings for different procedures.
    - b. Provide logical sequence of instructions for each procedure.
  5. Copy of each warranty, bond and service contract issued
    - a. Provide information sheet for Owner's personnel, giving:
      - 1) Proper procedures in event of failure
      - 2) Instances that might affect validity of warranties or bonds
  6. Shop drawings, coordination drawings and product data as specified.
- C. Sections for Equipment and Systems
1. Content for each unit of equipment and system as appropriate:
    - a. Description of unit and component parts:
      - 1) Function, normal operating characteristics, and limiting conditions.
      - 2) Performance curves, engineering data and tests.
      - 3) Complete nomenclature and commercial number of replaceable parts.
    - b. Operating procedures:
      - 1) Start up, break-in, routine / normal operating instructions
      - 2) Regulation, control, stopping, shut down and emergency instructions
      - 3) Special operating instructions
    - c. Maintenance procedures:
      - 1) Routine operations
      - 2) Guide to trouble-shooting
      - 3) Disassembly, repair and reassembly
      - 4) Alignment, adjusting and checking
      - 5) Routine service based on operating hours
    - d. Manufacturer's printed operating and maintenance instructions.
    - e. Original manufacturer's parts list, illustrations, assembly drawings and diagrams required for maintenance.
      - 1) Items recommended to be stocked as spare parts.
    - f. Schedule of low voltage wire and cable
    - g. Schedule of ESS equipment
    - h. Schedule of ESS field devices
    - i. Each Contractor's coordination drawings.
      - 1) As installed color coded wiring and cabling diagrams.
    - j. List of original manufacturer's spare parts and recommended quantities to be maintained in storage.
    - k. Other data as required under pertinent sections of the specifications.
  2. Prepare and include additional data when the need for such data becomes apparent during instruction of Owner's personnel.
  3. Additional requirements for operating and maintenance data as outlined in respective sections of specifications
  4. Provide complete information for products specified in Division 27.
  5. Provide certificates of compliance as specified in each related section.
  6. Provide start up reports as specified in each related section.
  7. Provide signed receipts for spare parts and material.
  8. Provide training report and certificates.

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SECTION 28 05 00

ELECTRONIC SAFETY AND SECURITY  
BASIC MATERIALS, METHODS, AND GENERAL PROVISIONS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

- A. Except as modified in this Section, General Conditions, Supplementary Conditions, applicable provisions of Division 01 General Requirements, and other provisions and requirements of the Contract Documents apply to work of Division 28 Electronic Safety and Security.
- B. Applicable provisions of this section apply to all sections of Division 28, Electronic Safety and Security.
- C. The general provisions of the Contract and the requirements of the following Sections apply to the Work specified in this Section. See following sections for related general and specific requirements following sections shall associate with this specification as applicable.
  - 1. Division 26 in its entirety.
  - 2. Division 27 in its entirety.
  - 3. Division 28 in its entirety.
- D. The entire drawing and specification package apply to the work specified in the Electronic Safety and Security specifications and shall be complied with in every respect. The Contract Documents are comprised of the drawings and specifications. The Contractor shall examine these Contract Documents, and coordinate required work indicated in each.

1.2 CODES AND STANDARDS

- A. All equipment and work performed shall comply with all of the current and applicable Codes, Rules, Ordinances, Regulations and Standards (including those not specifically listed in this Specification) as interpreted and enforced by the authorities having jurisdiction including:
  - 1. Americans with Disabilities Act (ADA)
  - 2. Authorities Having Jurisdiction (AHJ) - Local
  - 3. American National Standards Institute (ANSI)
  - 4. American Society of Testing and Materials (ASTM) *Communications Cables - B694, B736, D4565, D4566, D4730, D4731, D4732*
  - 5. Building Industry Consulting Services International (BICSI)
  - 6. Code of Federal Regulations - Title 47
  - 7. Electronics Industries Association (EIA) *Standard Test Procedures for Fiber Optic Fibers, Cables, Transducers, Connecting and Terminating Devices - EIA-455 Series*
  - 8. Federal Communications Commission (FCC) - Communications Act and FCC Rules
  - 9. Federal Information Processing Standards (FIPS) *Federal Building Standard for Telecommunications Pathways and Spaces - FIPS PUB 175, FIPS PUB 176*
  - 10. The Insulated Cable Engineers Association (ICEA) *Communications Cable Stands - P-47-434, S-56-434, S-80-576, S84-608, S-85-625, S-86-634, S-87-640, S-89-648, S-90-661, S-98-688, S-99-689, S-100-685*
  - 11. International Electro-technical Commission (IEC)
  - 12. Institute of Electrical and Electronic Engineers (IEEE) *Local Area Networks/Metropolitan Networks Standards Collection - LAN/MAN 802 Series*
  - 13. International Organization for Standardization (ISO) (ISO/IEC) *Premise Wiring Core and LAN/MAN Core Equivalents-11801, 8802, 14763-1*
  - 14. International Telecommunication Union (ITU-T) *Telecommunications Standardization*
  - 15. National Electrical Code (NEC) *National Electrical Code - NFPA 70*
  - 16. National Electrical Contractor's Association (NECA) *Standards of Installation*
  - 17. National Electrical Manufacturers Association (NEMA) *Performance Standard for Twisted Pair Premise Voice and Data Communications Cable-WC 63.1, WC 63.2, WC 66*
  - 18. National Electrical Safety Code (NESC)
  - 19. National Fire Protection Association (NFPA) - *National Fire Alarm Code NFPA 72, Life Safety Code NFPA 101*
  - 20. Society of Cable Telecommunications Engineers (SCTE)

21. Local Accessibility Standards
  22. Telecommunications Industries Association (TIA) (*ANSI/TIA/EIA Wiring and Cabling Standards - 526, 568, 569, 570, 571, 598, 606, 607, 758, TSB 31-B, 63, 67, 72, 75 and 95*)
  23. Uniform Building Code (UBC)
  24. Underwriters Laboratories, Inc. (U.L.) - *497A, 910, 1077, 1863, 1283, 1459, 1604, 1651, 1681, 1690, 1778, 1977*
- B. Resolve any code violations discovered in contract documents with the Engineer prior to award of the contract. After Contract award, any correction or additions necessary for compliance with applicable codes shall be made at no additional cost to the Owner.
- C. This Contractor shall be responsible for being aware of and complying with asbestos NESHAP regulations, as well as all other applicable codes, laws and regulations.
- D. Obtain all permits required.

### 1.3 SUMMARY

- A. The work covered by the specifications includes furnishing materials, labor, transportation, tools, permits, fees, utilities, and incidentals necessary for the complete installation of work required in the Contract Drawings.
- B. It is the intent of the Contract Documents to provide a new and/or an extension of the existing installation, as shown in the associated specifications and drawings, complete in every respect.
- C. Provide complete and working ESS Systems including equipment, conduit, wiring, material, labor and training as described in this Specification and the Drawings. The ESS Systems Drawings and Specifications are the sole property of the Architect and are not to be duplicated, scanned, loaned or in any way made available to persons not designated as authorized by the Architect. All ESS Systems plans and specifications are to be returned to the Architect following completion of bid.

### 1.4 CONTRACTOR'S QUALIFICATIONS

- A. An approved contractor for the work under this division shall be:
1. A specialist in this field and have the personnel, experience, training, and skill, and the organization to provide a practical working system.
  2. Able to furnish evidence of having contracted for and installed not less than ten (10) systems of comparable size and type that have served their Owners satisfactorily for not less than 3 years.
  3. Perform work by persons qualified to produce workmanship of specified quality. Persons performing work shall be required to be licensed. Onsite supervision shall have minimum of the following:
    - a. Licenses, as applicable to the system being installed
    - b. Manufacturer's Certifications
      - 1) Firm Certification
      - 2) Installer Certification
      - 3) Programmer's Certification
      - 4) System Designer Certification.

### 1.5 DRAWINGS AND SPECIFICATIONS

- A. The drawings and these specifications are complementary to each other, and what is required by one shall be as binding as if required by both.
- B. If variations or departures from the drawings are deemed necessary by the Contractor, details of such departures and the reasons therefore shall be submitted to the Consultant for review. No departures shall be made without prior written acceptance of the Consultant.
- C. Should the drawings or specifications disagree in themselves or with their counterpart, the better quality or greater quantity of work or materials shall be estimated upon, and unless otherwise directed by the Consultant in writing, shall be performed or furnished. In the case that the specifications should not fully agree with the Schedules, the latter shall govern. Figures indicated

on drawings govern scale measurements and large-scale details govern small scale drawings.

- D. The approximate locations of system equipment and components are indicated on the Drawings. These Drawings are not intended to give complete and accurate details in regard to location of equipment, field devices, etc. Exact locations are to be determined by actual measurements at the building and will in all cases be subject to the Review of the Owner or Consultant, who reserves the right to make any reasonable changes in the locations indicated without additional cost to the Owner.
- E. Items specifically mentioned in the Specifications but not shown on the Drawings and/or items shown on Drawings but not specifically mentioned in the Specifications shall be installed by the Contractor under the appropriate section of work as if they were both specified and shown.
- F. Any discrepancies between the Contract Documents and actual job site conditions shall be reported to the Owner or Consultant, so that they will be resolved prior to the bidding, where this cannot be done at least 7 working days prior to bid; the greater or costlier of the discrepancy shall be bid. All labor and materials required to perform the work described shall be included as part of this Contract.
- G. It is the intention of this Section of the Specifications, and associated drawings, to outline minimum requirements to furnish the Owner with a turnkey and fully operating system in cooperation with other trades.
- H. The contract documents are schematic in nature in that they are only to establish scope and a minimum level of quality. They are not to be used as actual working construction drawings. The actual working construction drawings shall be the shop drawings accepted by project's consultant.
- I. The Contractor shall be responsible for coordination and proper relation of his work to the building structure and to the work of all trades. The Contractor shall visit the premises and thoroughly familiarize himself with the existing site conditions, details of the work and the working conditions, and verify dimensions in the field. The Contractor shall advise the project's consultant of any discrepancy prior to bidding. The submission of bids shall be deemed evidence of the Contractor's site visit; coordination of existing conditions and include consideration for existing conditions.
- J. These documents are conceptual in nature. It shall be the responsibility of the approved installer to furnish a complete and functional system, including the items shown on the drawings, in the specifications, and items not designated in either. The installer's shop drawings and product data submittals shall represent a complete system and documents accepted by the project's consultant shall not relieve the installer from being required to provide any materials, equipment, or labor to furnish a complete and functional system as recognized by the Project's Technology Consultant and the Owner.

#### 1.6 BUILDING CONSTRUCTION AND LAYOUT OF WORK

- A. General: It shall be the responsibility of the Contractor to consult the Engineering Drawings and Details so as to thoroughly familiarize himself with the type and quality of construction to be provided on this project.
- B. The drawings are diagrammatic in nature and do not show every connection in detail or every line or conduit in its exact location. These details are subject to the requirements of all codes, ordinances, and standards; as well as all structural and architectural conditions. The Contractor shall carefully investigate structural and finish conditions and shall coordinate the separate trades in order to avoid interference between the various phases of work. Work shall be laid out so that it will be concealed in closed ceiling space and/or furred chases unless specifically noted or indicated to be exposed. Work shall be installed to avoid crippling of structural members. All work shall be run parallel or perpendicular to the lines of the building unless otherwise noted.
- C. The approximate location of equipment items is indicated on the drawings. Exact locations are to be determined by coordination of dimensions from approved equipment submittals and site-verified field measurements and will in all cases be subject to the approval of the Consultant. The Consultant reserves the right to make any reasonable changes in the indicated locations prior to installation for no additional cost.

- D. In areas of existing special ceiling construction, the removal and restoration must be carefully planned such that the existing condition of the ceilings is maintained. It may be necessary for the Contractor to procure a Subcontractor familiar with this work to achieve this requirement.
- E. Consider space limitations imposed by contiguous work in selection and location of equipment and material. Do not provide equipment or material that is not suitable in this respect.

#### 1.7 RELATION WITH OTHER TRADES

- A. Carefully study all matters and conditions concerning the project. Submit notification of conflict in ample time to prevent unwarranted changes in any work. Review other Divisions of these specifications to determine their requirements. Extend electrical services and final connections to all items requiring same.
- B. Because of the complicated relationship of this work to the total project, conscientiously study the relation and cooperate as necessary to accomplish the full intent of the documents.
- C. Where cabling pass through walls or floors, metal sleeves shall be provided and shall be sealed to prevent spread of fire and smoke. In walls, they shall extend 3" beyond the finished surface. In pipe chases, they shall extend 8" inches above floor slab and be cemented in a watertight manner. Size of these sleeves shall be at least as required to maintain a maximum 40% conduit fill ratio. 1/2 inch greater than outside diameter of the conduit.
- D. Locate and size openings required for installation of work specified in this Division in sufficient time to prevent delay in the work.
- E. Refer to other Divisions of the specifications for the scope of required connections to equipment furnished under other Division. Determine from the General Contractor / Construction Manager for the various trades, the Owner, and by direction from the Architect / Engineer, the exact location of all items. The construction trades involved shall furnish all roughing-in drawings and wiring diagrams required for proper installation of the electrical work.
  - 1. Make final connections to all ESS equipment indicated on the drawings, except as noted.
- F. Request all Shop Drawings required in ample time to permit proper installation of all electrical provisions.
- G. Extend services as indicated to the various items of equipment furnished by others. Rough-in for the various items and make final connections ready for operation upon placing of the equipment.

#### 1.8 CONCEALED AND EXPOSED WORK

- A. When the word "concealed" is defined as hidden from sight as in chases, furred spaces or above ceilings. "Exposed" is defined as open to view, in plain sight.

#### 1.9 GUARANTEE

- A. Guarantee work for a minimum of two years or as noted longer elsewhere from the date of substantial completion of the project. During that period make good any faults or imperfections that may arise due to defects or omissions in material, equipment or workmanship. At the Owner's option, replacement of failed parts or equipment shall be provided.

#### 1.10 MATERIAL AND EQUIPMENT

- A. Furnish new and unused materials and equipment meeting the requirements of the paragraph specifying acceptable manufacturers. Where two or more units of the same type or class of equipment are required, provide units of a single manufacturer.

#### 1.11 NOISE AND VIBRATION

- A. Select equipment to operate with minimum noise and vibration. If noise or vibration is produced or transmitted to or through the building structure by equipment, piping, ducts or other parts of work,

and judged objectionable by the Owner, Architect, or Engineer, rectify such conditions at no additional cost to the Owner. If the item of equipment is judged to produce objectionable noise or vibration, demonstrate at no additional cost that equipment performs within designated limits on a vibration chart.

#### 1.12 ACCEPTABLE MANUFACTURERS

- A. Manufacturers names and catalog number specified under sections of Division 28 are used to establish standards of design, performance, quality and serviceability and not to limit competition. Equipment of similar design, equal to that specified, manufactured by a named manufacturer shall be acceptable on approval. A request for prior approval of equipment not listed must be submitted ten (10) days before proposal due date. Submit complete design and performance data to the Architect. The Architect and Owner issue approvals of acceptable manufacturers as addenda to the Construction Proposal Documents.
- B. Where acceptable manufacturers are listed, only products of those manufacturers may be provided. Additionally, the product must meet all the detailed requirements of the specifications.
- C. If no manufacturer's name is mentioned, the Contractor shall provide equipment and material which meet the specifications.

#### 1.13 UTILITIES, LOCATIONS AND ELEVATIONS

- A. Locations and elevations of the various utilities included within the scope of this work:
  - 1. Obtained from utility maps and other substantially reliable sources.
  - 2. Are offered separate from the Contract Documents as a general guide only without guarantees to accuracy.
- B. Examine the site and verify the location and elevation of all utilities and of their relation to the work. Existing utilities indicated on the site plans are for reference only and shall be field verified by the Contractor with the respective public or private utility.

#### 1.14 CONTRACT DRAWINGS

- A. Contract drawings are diagrammatic only and do not give fully dimensioned locations of various elements of work. Determine exact locations from field measurements.
- B. It is the responsibility of the Contractor to compare the scale of all electrical drawings with the scale of the architectural drawings and make adjustments to all electrical drawings which have the incorrect drawing scale so that his material takeoffs are not in error due to an incorrectly labeled drawing scale and his proposal is complete.

#### 1.15 ABBREVIATIONS AND DEFINITIONS

Abbreviations:

AV	Audio/Visual
AWG	American Wire Gauge
BCR	Building Communications Room
CMP	Communications Media Plenum
CMR	Communications Media Riser
dB	Decibel
EMI	Electromagnetic Interference
ER	Equipment Room
ESS	Electronic Safety and Security
FACP	Fire Alarm Control Panel
FCR	Floor Communications Room
Hz	Hertz
IDF	Intermediate Distribution Frame
Km	Kilometer
LCD	Liquid Crystal Display
LED	Light Emitting Diode

M	Micron
MDF	Main Distribution Frame
MHz	Megahertz
NEXT	Near-End Cross Talk
nm	Nano-meter
OFN	Optical Fiber Non-conductive
OFNP	Optical Fiber Non-conductive Plenum
OFNR	Optical Fiber Non-conductive Riser
OTDR	Optical Time Domain Reflectometer
TC	Telecommunications Closet ( <i>Now referred to as TR</i> )
TR	Telecommunications Room ( <i>A.K.A. TC - Telecommunication Closet</i> )
UTP	Unshielded Twisted Pair Wire

Definitions:

Low Voltage Wire - Wire or cable used for one or more systems that operate on 24 volts or less. Low Voltage Wire is used to install and interconnect one or more of the ESS Systems. Low Voltage Wire includes patch cords, jumpers and all portions of cable or wire used to make the ESS Systems operational or for system communications.

Electronic Safety and Security Systems - One or more of the following and associated equipment: Fire Detection/Alarm Systems, Intrusion Detection/Alarm Systems, Access Control Systems, Video Surveillance Systems,

#### 1.16 QUALITY ASSURANCE

- A. Equipment Standards:
  1. System and all components shall be brand new stock from manufacturer.
  2. All electronics shall be 100% solid state.
  3. System and all components shall bear a UL Label.
- B. Contractor Qualifications:  
At the time of Proposal, the Contractor shall:
  1. Have manufactured, supplied or installed at least three (3) other systems of similar size, complexity, and general operation as the systems described in these specifications. The Contractor shall furnish in writing to Architect proof of compliance with this paragraph at the time of proposal.
  2. Hold all legally required Texas State Contractor's licenses necessary to accomplish the installation and activation of the described system at the facilities indicated. The Contractor shall submit copies of licenses to the Architect prior to the start of work
  3. Hold all legally required state registrations to meet local requirements for submittal drawings.
  4. Have a local office within fifty (50) miles of the project site staffed with factory trained technicians who have experience on systems of similar complexity and function as the systems described in these specifications. These technicians shall be fully capable of system engineering support, installation supervising, system start-up, and providing the Owner with training and service on both hardware and software for the systems specified.
  5. Certify complete and total compliance with the provisions of these specifications by letter or submittal of the proposal response forms, signed by an officer of the corporation, or a principal if other ownership currently exists. In addition, the letter or forms shall include a complete listing of exceptions, if any.

#### 1.17 SUBMITTALS

- A. Provide SUBMITTALS according to Division 1 and the following.
- B. Requirements:
  1. Submit paragraph-by-paragraph specification review indicating compliance or deviation with explanation.
  2. Submit proof that all system components and cables are U.L. Listed.
  3. An equipment list with names of manufacturers, model numbers, and technical information

- on all equipment proposed. Clearly mark exact model number proposed to be installed.
4. Product technical information sheets for each principal components in the proposed system, including cable, wire, terminal marking, and wire marking material.
  5. Certification from the manufacturer stating that the system Contractor is an authorized distributor or installer of the proposed system when such certifications exist.
  6. A statement listing every technical and operational parameter wherein the submitted equipment varies from that which was originally specified. If the submitter fails to list a particular variance and his submittal is accepted, but is subsequently deemed to be unsatisfactory because of the unlisted variance, the submitter shall replace or modify such equipment at once and without cost to the Owner.

1.18 EXAMINATION OF SITE

- A. The Contractor shall have visited the site and familiarized himself with all existing conditions prior to submitting his proposal and shall be prepared to carry out the work within the existing limitations. Failure or neglect to do so shall not relieve the Contractor of his responsibilities not entitle him to additional compensation for work overlooked and not included in his proposal.
- B. The Contractor shall confirm the availability of the proper power source for each piece of specified equipment, through site visits and Drawings as necessary. Where proper power does not exist, the Contractor shall provide the required power, circuits, outlets, conduits, and wire as specified under Division 26.

1.19 DATA ACCURACY

- A. Absolute accuracy of information regarding existing conditions cannot be guaranteed. The Drawings and Specifications are for the assistance and guidance of the Contractor and exact locations, distances, elevations, etc., shall be governed by actual field conditions. Where variations from the contract documents are required, such variations shall be approved by the Architect / Owner.

1.20 SECURITY

- A. The Contractor is responsible for complying with all of the Owner's and facility security's requirements to prevent theft or damage to equipment, tools and materials. If any deviation from facility security requirements is necessary, approval for such deviation shall be coordinated with the Owner.
- B. The Contractor shall not disclose any confidential information of the Owner. The Contractor acknowledges that such action is highly injurious and can do damage to the Owner. The Contractor will agree to and comply with the standard policies and provisions of the Owner regarding outside Contractors and Consultants.

1.21 UTILITIES

- A. It shall be the responsibility of the Contractor to provide all temporary connection and cables, lighting, light stands and power. The facilities shall be used in accordance with all applicable regulations regarding operations, safety and fire hazards of the governmental Authorities Having Jurisdiction, provided they are not used in a wasteful manner.

1.22 PERMITS

- A. All permits required for the specified performance and completion of the work shall be secured by the Contractor. These permits shall be presented and reviewed at the initial project progress meeting.

1.23 NOTIFICATION

- A. The Contractor shall not shut off any existing systems. The Contractor shall give the Owner at least ten (10) calendar day's notice of any requirements to shut off or interference with existing alarm, regulating, computer or other service systems. The Owner will arrange and execute any shutdown. All work such as splicing, connections, etc., necessary to establish or re-establish any system shall

be completed by the Contractor in close coordination with the Owner.

#### 1.24 INTERFERENCES WITH THE OWNER

- A. Transportation and storage of materials at the facility, work involving the facility, and all other matters affecting the habitual use by the Owner of its buildings, shall be conducted so as to cause the least possible interference, and at times and in a manner acceptable to the Owner. The Contractor shall make every effort to delivery equipment per the schedule required by the project.

#### 1.25 PROJECT RECORD DOCUMENTS

- A. Maintain at the job site a separate set of white prints (blue line or black line) of the contract drawings for the sole purpose of recording the "as-built" changes and diagrams of those portions of work in which actual construction is significantly at variance with the contract drawings. Mark the drawings with a colored pencil. Prepare, as the work progresses and upon completion of work, reproducible drawings clearly indicating locations of various major and minor feeders, equipment, and other pertinent items, as installed. Record underground and underslab cables installed, dimensioning exact location and elevation of such installations.
- B. At conclusion of project, obtain without cost to the Owner, electronic AutoCAD 2014+ / Revit CAD files of the original drawings and transfer as-built changes to these. Provide the following as-built documents including all contract drawings regardless of whether corrections were necessary and include in the transmittal: "2 sets of CDs and prints for Owner's use, one set of CDs, prints, and mylars for Architect / Engineers Records". Delivery of these as-built electronic, reproducible and prints is a condition of final acceptance.
  - 1. 3 sets of electronic AutoCAD (2014+ dwg) / Revit CAD drawing files, on CD-ROM media, of each contract as-built drawing.
  - 2. One reproducible Dayrex mylar film positive of each contract as-built drawing.
  - 3. Three sets of blue or black-line prints of each contract as-built drawing.
- C. As-Built Drawings should indicate the following information as a minimum:
  - 1. Indicate all addendum changes to documents.
  - 2. Remove Engineer's Seal, name, address, and logo from drawings.
  - 3. Mark documents AS-BUILT DRAWINGS.
  - 4. Clearly indicate: DOCUMENT PRODUCED BY:
  - 5. Indicate all changes to construction during construction. Indicate actual routing of all conduit and cables, etc that were deviated from construction drawings.
  - 6. Indicate exact location of all underground ESS raceways, and elevations.
  - 7. Correct schedules to reflect (actual) equipment furnished and manufacturer.
  - 8. During the execution of work, maintain a complete set of Drawings and specifications upon which all locations of equipment, devices, and all deviations and changes from the construction documents in the work shall be recorded.
  - 9. Exact location of all ESS equipment in building. Label panel schedules to indicate actual location.
  - 10. Exact location of all ESS equipment in and outside of the building.
  - 11. Location, size and routing of all ESS cables, conduits, equipment, etc. shall be accurately and neatly shown to dimension.
  - 12. Exact location of all roof mounted equipment, wall, roof and floor penetrations.
  - 13. Cloud all changes.

#### 1.26 OPERATING TESTS

- A. After all ESS systems have been completed and put into operation, subject each system to an operating test under design conditions to ensure proper sequencing and operation throughout the range of operation. Tests shall be made in the presence of the Architect / Engineer and Owner. Provide minimum 24-hour advance notice of scheduling of all tests. Make adjustments as required to ensure proper functioning of all systems. Special tests on individual systems are specified under individual sections. Submit 3 copies of all certifications and test reports adequately in advance of completion of the work to allow for remedial action as required to correct deficiencies discovered in equipment and systems.

#### 1.27 WARRANTY



- A. All equipment shall be covered for the full manufacturers warranty period and systems shall be warranted by the Contractor for a period of two years commencing with the filing date of substantial completion. The Warranty shall cover all costs for warranty service, including parts, labor, prompt field service, pick-up, transportation, delivery, reinstallation, and retesting. A contract for service shall cover the period starting with the first expected activation of each system and shall continue without interruption to cover the period to the end of the two-year warranty as defined above. The end of the warranty period shall be handled such that a smooth transition to a maintenance agreement with the Owner shall be achieved with no lapse in coverage.
- B. Submit 3 copies of all warranties and guarantees for systems, equipment, devices and materials. These shall be included in the Operating and Maintenance Manuals.

1.28 BUILDING CONSTRUCTION

- A. It shall be the responsibility of the sub-contractor to consult the Architectural and Engineering drawings, details and specifications and thoroughly familiarize himself as to the construction and all job-related requirements. All construction trades shall cooperate with the General Contractor / Construction Manager job site superintendent and lay out work so that all piping, cables, pathways, raceways, and other items are placed in the walls, furred spaces, chases, etc., so that there shall be no delay in the job.

1.29 TEMPORARY FACILITIES

- A. General: Refer to Division 01 for general requirements on temporary facilities.
- B. Temporary Wiring: Temporary power and lighting for construction purposes shall be provided under Division 26. Installation of temporary power shall be in accordance with NEC Article 305.
- C. Temporary facilities, wire, lights and devices are the property of this Contractor and shall be removed at the completion of the Contract.

1.28 EXTRA MATERIALS

- A. Keys: Provide three (3) sets of all keys for system cabinets.

PART 2 - PRODUCTS

2.1 WORK INCLUDED

- A. All materials listed in PART 2 - PRODUCTS of this Division Sections and on the Drawings shall be provided by the Contractor unless specifically excluded or modified in other portions of this Specification or Addendums.

2.2 GENERAL MATERIALS AND EQUIPMENT REQUIREMENTS

- A. Materials, in general, shall conform to the National Electrical Code requirements and shall be listed, inspected, and approved by the Underwriters Laboratories and shall bear the UL label where labeling service is available. The label or listing of the Underwriters Laboratories, Inc. will be accepted as evidence that the materials or equipment conform to the applicable standards of that agency. In lieu of this listing, the Contractor may submit a statement from a nationally recognized, adequately equipped testing agency, indicating that the items have been tested in accordance with required procedures, and that the materials and equipment comply with all Contract requirements.

2.3 STANDARD PRODUCTS

- A. Materials and equipment shall be the standard catalog products of manufacturers regularly engaged in the manufacture of products conforming to these specifications and shall essentially duplicate materials and equipment that have been in satisfactory use at least two (2) years prior to bid opening. Where custom or special items are required, these shall be fully described using drawings, material lists, etc., which fully describe in detail the item proposed for use on this project.

## 2.4 MANUFACTURE'S INSTRUCTIONS

- A. The Contractor is responsible for furnishing the proper Electronic Safety and Security equipment and/or material and for seeing it is installed as intended by the manufacturer. The Contractor shall, wherever necessary, request advice and supervisory assistance from equipment manufacturers as required for the proper installation, operation, or start-up. The Contractor shall notify the Consultant, in writing, of any conflict between the Contract Documents and the manufacturer's recommendations and shall obtain, from the Consultant, instructions/direction before proceeding with the work. The Contractor shall pay for all costs resulting from deficiencies created by installation not in accordance with the manufacturer's recommendations or the instructions of the Consultant.

## 2.5 RUST PREVENTION

- A. Metallic materials shall be protected against corrosion. Exposed metallic parts of equipment exposed to the elements shall be given a rust inhibiting treatment and standard finish by the manufacturer. Components such as boxes, bodies, fittings, guards, and miscellaneous parts shall be protected in accordance with the ASTM A123 or A153, except where other equivalent protective treatment is specifically approved in writing.

## 2.6 STORAGE AT SITE

- A. The Contractor shall not receive material or equipment at the job site until ready for installation or until there is suitable space provided to properly protect equipment from rust, weather, humidity, dust, or physical damage.
- B. All electronic equipment, containing sealed lead acid batteries or gel cells, shall be stored in climate-controlled area until installed or reinstalled. Do not store in non-climate controlled connex storage units.
- C. Storage is to be provided and secured by the contractor. In the event that the Owner should agree to furnish storage space, security of the space and its contents shall remain the responsibility of the contractor.

## 2.7 CONDITION OF MATERIALS

- A. All materials required for the installation of the Electronic Safety and Security systems shall be new and unused. Any material or equipment damaged in transit from the factory, during delivery to premises, while in storage on premises, while being installed, or while being tested, until time of final acceptance, shall be replaced by this Contractor without extra cost to Owner.

## 2.8 NAMEPLATES

- A. Factory assembled components and equipment shall be provided with be factory stamped labeling. Labeling will have information required to specifically identify the component and/or equipment in the future such as the manufacturer's name, catalog number, serial number, etc. All data on the labels shall be legible at the time of final inspection.

## 2.9 ACCESS DOORS

- A. Wherever access is required in walls or ceilings to concealed junction boxes, pull boxes, equipment, etc., installed under this Division, furnish a hinged access door and frame with flush latch handle to another Division for installation. Doors shall be as follows:
  - 1. Plaster Surfaces: Milcor Style K.
  - 2. Ceramic Tile Surfaces: Milcor Style M.
  - 3. Drywall Surfaces: Milcor Style DW.
  - 4. Install panels only in locations approved by the Architect.

## 2.10 SPACE LIMITATIONS

- A. Equipment shall be chosen which shall properly fit into the physical space provided and shown on the drawings, allowing ample room for access, servicing, removal and replacement of parts, etc.

Adequate space shall be allowed for clearances in accordance with applicable codes and standards. Physical dimensions and arrangement of equipment shall be subject to the approval of the Consultant.

### PART 3 - EXECUTION

#### 3.1 INSTALLATION:

- A. This project has a critical path, which must be closely followed in order to meet the completion date. The Contractor shall review the proposed schedule at the Award of Contract meeting and be prepared to staff his work force according to the schedule constraints presented at that time.
- B. Aesthetics are an important consideration in this installation. All components shall be installed so as to have aesthetically pleasing results as determined by the Owner and Architect. Actual locations of all visible components shall be coordinated in advance with the Owner and Architect.
- C. Install, make fully operational and test the system as indicated on the Drawings and in the Specifications. Where information is not available the worst-case condition must be assumed to ensure a complete, functional system.
- D. Any interfacing with other systems shall be the Contractor's responsibility under this contract, and the details, both logical and physical, of such interfaces shall be reflected in the Submittals and As-Built drawings.
- E. If appropriate, interfaces with the Owner's Data Network or Telecommunications System shall be coordinated with the Owner and Architect.
- F. All necessary back boards, back-boxes, pull-boxes, connectors, supports, conduit, cable and wire shall be furnished and installed to provide a complete and reliable system. Exact location of all backboards, boxes, conduit and wiring runs shall be presented to the Owner / Architect for approval in advance of any installation. Provide as required and as specified in Division 26.
- G. Where required provide 120-VAC, 60 Hz power from nearest electrical panel through a junction box, to the system devices. Provide as required and as specified in Division 26.
- H. Where required, install conduit, cable and wire parallel and square with building lines, including raised floor areas. Conduit fills shall not exceed 40%.
- I. All equipment shall be mounted with sufficient clearance to minimize EMI as well as meet all applicable codes and facilitate observation and testing. Securely hand and/or fasten with appropriate fittings to ensure positive grounding, free of ground loops, throughout the entire system. Units shall be installed parallel and square to building lines.
- J. Quiet and vibration-free operation of all equipment is a requirement of this installation. Properly adjust, repair, balance or replace any equipment producing objectionable (in the judgment of the Owner or Architect) noise or vibration in any of the occupied areas of any building and provide additional brackets and bracing if necessary. Any such additions or changes shall be at no additional cost to the Owner.
- K. Installation shall comply with the CODES AND STANDARDS portion of this Section. Where more than one code or regulation is applicable, the more stringent shall apply.
- L. Where new equipment is replacing old equipment, the Contractor is responsible for removing and disposing of the old equipment and doing whatever repair work is necessary as specified by the Owner / Architect.
- M. Install firestopping, as specified in Division 26 for all penetrations in slabs and firewalls to meet code at the completion of work and prior to final testing demonstration to the Owner.
- N. The installation shall be performed in a professional manner.
- O. On a daily basis, clean up and deposit in appropriate containers all debris from work performed

under the appropriate specification sections. Stack and organize all parts, tools and equipment when not being used.

- P. Preparation, handling and installation shall be in accordance with the Manufacturer's written instructions and technical data appropriate to the product specified.
- Q. All work shall conform to the National Electrical Contractor's Association "Standard of Installation" for general installation practice.
- R. At the conclusion of the installation, all work areas, including all enclosures and boxes, shall be vacuumed and cleaned to remove all debris and grease.

### 3.2 COORDINATION WITH OWNER / ARCHITECT

- A. Close coordination with the Owner / Architect is vital to achieve a complete, aesthetically pleasing job. The Contractor shall ensure that the Owner / Architect is kept fully apprized of job progress.

### 3.3 CUTTING, PAINTING, AND PATCHING

- A. Structural members shall not be drilled, bored or notched in such a manner that shall impair their structural value. Cutting of holes in structural members, if required, shall be done with core drills and only with the specific approval of the Owner / Architect for each instance.
- B. All walls that require cutting or repair during the installation process shall be returned to their original condition, including the matching of colors and finishes to the satisfaction of the Owner / Architect, and at no additional cost to the Owner.

### 3.4 WIRE AND CABLE

- A. All low voltage cable shall be low smoke plenum rated, limited energy, with 300-volt insulation.
- B. All wires in exposed areas shall run through conduit as specified in Division 26.
- C. Provide conduits, cable trays, raceways, wireways, boxes and outlets as specified in Division 26.
- D. After installation, and before termination, all wiring shall be checked and tested to insure there are no grounds, opens, or shorts on any conductors. In addition, all wires between buildings or underground and all coax cables shall have insulation tested with a megohmmeter (megger) and a reading of greater than 20 megohms shall be required to successfully complete the test.
- E. Run wires continuously from termination to termination without splices.
- F. Wire and cable shall be supported in each equipment and terminal cabinet and in each terminal and pull box in vertical risers and horizontal runs with wire duct and strap-type supports. At any point where wire duct is required for good wire management, whether shown on elevations or not, install appropriate duct. Where terminal boards are used, wire ducts shall be supplied on both sides and at no time shall wires cross over terminal boards. Arrange cables neatly to allow inspection, removal and replacement. Lace cables as required. Spot tie wire bundles with plastic cable ties and securely affix to panels. If screw type terminals are specified, terminal strip connections shall be locking, tongue style, pressure crimp, and solderless spade lug.
- G. Visually inspect wire and cable for faulty insulation prior to installation. Protect cable ends at all times with acceptable end caps except during actual termination. At no time shall any coaxial cable be subjected to a bend less than a 6-inch radius. Protect wire and cable from kinks. Install 1 pull rope for all 2" or larger sized conduits.
- H. Provide plastic bushings and strain relief material at all conduit exit points and where necessary, to avoid abrasion of wire and excess tension on wire and cable.
- I. Cables above accessible ceilings shall not rest on ceiling tiles. Use Velcro tie wraps, J-hooks or D-rings to hold cables. Provide independent support for all cables. Support is to be from building structure (do not support from pipes or conduits). ESS cables shall not tie off on HVAC supports,

all-thread, ceiling grid hanger wire or electrical / mechanical piping system.

- J. Ground and bond equipment and circuits in accordance with NEC and Division 26.

### 3.5 IDENTIFICATION AND TAGGING

- A. All cables, wires, wiring forms, terminal blocks and terminals shall be identified by labels, tags to other permanent markings in accordance with TIA/EIA-606. The markings shall clearly indicate the function, source, or destination of all cabling, wiring and terminals. All cables and wires shall be identified, utilizing heat-shrink, machine printed, polyolefin wire markers (Brady Type B-32 or equal). Handwritten tags are not acceptable.
- B. Should a situation arise where the wire tagging format as shown on the drawings cannot be used, a substitute format shall be submitted which complies with the intent to provide documentation that will permit end-to-end tracing of all ESS Systems wiring.
- C. All panels shall be provided with permanently attached engraved lamacoid labels with identifying names and functions. All terminal points shall be appropriately labeled. Labels shall be consistent in form, color, and typeface throughout the system and all must contain the name of the system or subsystem as part of the label textual information. Design, color, font and layout shall be coordinated with, and approved by, the Owner.
- D. Identification of Equipment:
1. All major equipment shall have a manufacturer's label identifying the manufacturer's address, equipment model and serial numbers, equipment size, and other pertinent data. Take care not to obliterate this nameplate. The legend on all nameplates or tags shall correspond to the identification shown on the Operating Instructions.
  2. A black-white-black 3-layer laminated plastic engraved identifying nameplate shall be permanently secured to each wireway, terminal cabinet, and ESS cabinet or rack.
    - a. Identifying nameplates shall have 1/2-inch high, engraved letters.
  3. Permanent, waterproof, black markers shall be used to identify each ESS grid junction box, clearly indicating the type of system available at that junction box.
  4. Pull Boxes: Field work each with a nameplate showing identity, and identifying equipment connected to it. Nameplates shall also indicate where pull box is fed from.
- E. Prohibited Markings: Markings intended to identify the manufacturer, vendor, or other source from whom the material has been obtained are prohibited for installation in public, tenant, or common areas within the project. Also prohibited are materials or devices that bear evidence that markings or insignias have been removed. Certification, testing (example, Underwriters Laboratories), and approval labels are exceptions to this requirement.
- F. Warning Signs: Provide warning signs where there is hazardous exposure associated with access to or operation of ESS facilities. Provide text of sufficient size to convey adequate information at each location; mount permanently in an appropriate and effective location. Comply with industry standards for color and design.
- G. Wire and Cable Labeling: Provide wire markers on each conductor in all boxes, pull boxes, gutters, wireways. Identify with drop/circuit number.
- H. Underground Warning Tape: Thomas and Betts or approved equal. Six-inch wide plastic tape, colored red or orange with suitable warning legend describing buried ESS lines. All underground conduits shall be so identified. Tape shall be buried at a depth of 6-inches below grade and directly above conduits or ductbanks. Provide magnetic marking tape below all underground conduits.

### 3.6 CUTTING AND PATCHING

- A. General: Comply with the requirements of Division 01 for the cutting and patching of other work to accommodate the installation of electrical work. Except as authorized by the Architect / Engineer, cutting and patching of electrical work to accommodate the installation of other work is not permitted.

### 3.7 INSTRUCTION OF OWNER'S PERSONNEL

- A. Before proceeding with the instruction of Owner Personnel, prepare a typed outline, listing the subjects that will be covered in this instruction, and submit the outline for review by the Owner. At the conclusion of the instruction period obtain the signature of each person being instructed on each copy of the reviewed outline to signify that he has a proper understanding of the operation and maintenance of the systems and resubmit the signed outlines.
- B. Prior to substantial completion, conduct an on-site training program to instruct Owner's operating personnel in the operation and maintenance of the ESS systems.
  - 1. Provide the training during regular working day.
  - 2. The Instructors shall be experienced in their phase of operation and maintenance of the electrical systems and with the project.
- C. Time to be allocated for instructions.
  - 1. Minimum of 12 hours dedicated instructor time
  - 2. 4 hours on each of 3 days
  - 3. Additional instruction time for specific systems as specified in other Sections.
- D. Before on-site training, submit the program syllabus; proposed time and dates; for review and approval, minimum 48 hours prior to proposed training time and date.
  - 1. One copy to the Owner
  - 2. One copy to the Architect / Engineer
- D. The Owner shall provide a list of personnel to receive instructions and shall coordinate their attendance at the agreed upon times.
- E. Use operation and maintenance manuals as the basis of instruction. Review manual with personnel in detail. Explain all aspects of operation and maintenance.
- F. Demonstrate start-up, operation, control, adjustment, troubleshooting, servicing, maintenance, and shut down of each item of equipment.
- G. Demonstrate equipment functions (both individually and as part of the total integrated system).
- H. Prepare and insert additional data in the operating and maintenance manuals when the need for additional data becomes apparent during instructions.
- I. Submit a report within one week after completion of training. List time and date of each demonstration, hours devoted to the demonstration, and a list of people present, with their respective signatures.
- J. At the conclusion of the on-site training program, have the person designated by the Owner sign a certificate to certify that he/she has a proper understanding of the system, that the demonstrations and instructions have been satisfactorily completed, and the scope and content of the operating and maintenance manuals used for the training program are satisfactory.
- K. Provide a copy of the report and the certificate in an appropriately tabbed section of each Operating and Maintenance Manual.

### 3.8 OPENINGS

- A. Framed, cast or masonry openings for boxes, equipment or conduits are specified under other divisions. Drawings and layout work for exact size and location of all openings are included under this division.

### 3.9 OBSTRUCTIONS

- A. The drawings indicate certain information pertaining to surface and subsurface obstructions, which has been taken from available drawings. Such information is not guaranteed, however, as to accuracy of location or complete information.
  - 1. Before any cutting or trenching operations are begun, verify with Owner's representative, utility companies, municipalities, and other interested parties that all available information

- has been provided.
2. Should obstruction be encountered, whether shown or not, alter routing of new work, reroute existing lines, remove obstruction where permitted, or otherwise perform whatever work is necessary to satisfy the purpose of the new work and leave existing services and structures in a satisfactory and serviceable condition.
- B. Assume total responsibility for and repair any damage to existing utilities or construction, whether or not such existing facilities are shown.

3.10 VANDAL RESISTANT DEVICES

- A. Where vandal resistant screws or bolts are employed on the project, deliver to the Owner 2 suitable tools for use with each type of fastener used.
- B. Proof of delivery of these items to the Owner shall be included in the Operating and Maintenance Manuals.

3.11 PROTECTION

- A. Protect work, equipment, fixtures, and materials. At work completion, work must be clean and in original manufacturer's condition.
- B. Do not deliver equipment to this project site until progress of construction has reached the stage where equipment is actually needed or until building is closed in enough to protect the equipment from weather. Equipment allowed to stand in the weather shall be rejected, and the contractor is obligated to furnish new equipment of a like kind at no additional cost to the Owner.

3.12 EQUIPMENT BACKBOARDS

- A. Backboards: ¾ inch, fire retardant, exterior grade plywood, painted gray, both sides.
1. Provide minimum of two 4-ft. by 8-ft. sheets of plywood for each location shown.
2. Provide minimum of two 4-ft. by 4-ft. sheets of plywood for each ESS location.

3.13 SITE MANAGEMENT RESPONSIBILITY

- A. The Contractor shall provide an on-site Project Manager as defined in CONTRACTOR'S QUALIFICATIONS portion of this Section.

3.14 DEMOLITION AND RELOCATION

- A. The Contractor shall modify, remove, and relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain as directed by the Owner. Materials and items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to the approval of the Owner. The Contractor may substitute new materials and items of like design and quality in lieu of materials and items to be relocated, if approved by the Owner.
- B. All items scheduled for relocation and/or reuse shall be inspected by the Contractor and the Owner or his authorized representative. A written report of the condition of each item shall be made and provided to the Consultant. Where items scheduled for relocation and/or reuse are considered unsuitable for reuse, the Contractor shall so notify the Consultant and await reinstallation instructions before proceeding with removal. Items damaged in reinstallation shall be repaired or replaced by the Contractor as directed by the Owner at no additional cost to the Owner or the Consultant.
- C. All items which are to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean, repair, and provide all new materials, fittings, and appurtenances required to complete the relocation and to restore the items to good operative order. All relocations shall be performed by workmen skilled in the work ad in accordance with standard practice of the trades involved.

- D. Service lines and wiring to items to be removed, salvaged, or relocated shall be removed to points as indicated on the drawings, specified, or acceptable to the Owner. Service lines and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied off or connections into the existing facilities in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities which must remain in operation during the construction period shall not be interrupted without prior specific written approval of the Consultant.

### 3.15 EXISTING SYSTEM TESTING

- A. Contractor shall have each low voltage system tested prior to the commencement of construction. Systems shall include all systems that fall under the Division 28 umbrellas, as identified in the Division 2 of the Construction Specifications Institute (CSI) current Master Format7 Test shall include the functionality of all field devices and equipment. Any failures or items found to be functioning not to specification, shall be reported prior to construction. Any items found to be improperly or non-functioning upon the completion of the project, shall be replaced and/or repaired, by the contractor, at no additional cost to the project or the owner.
- B. Contractor shall document the location and any ID tag, MAC address, IP address, or bar code of any existing device that is to be removed from its current location. Devices that are to remain, shall be reinstalled in the exact location that they reside in prior to construction, unless noted otherwise.
- C. Any individual/firm that will be removing, relocating, reinstalling, or tampering with any devices; shall be licensed by the state and certified by the manufacturer of the system.
- D. Contractor shall remove any devices where construction occurs to prevent possible damage to the device. Removal of any devices which support user connection or other systems, shall be coordinated with the owner prior to removal and/or taking offline.

### 3.16 START-UP RESPONSIBILITY

- A. The Contractor shall initiate System operation. The Contractor shall provide competent Start-Up personnel on each consecutive working day until all ESS Systems are functional and ready to start the acceptance test phase. If the Contractor, in the Owner / Architect's judgment, is not demonstrating progress in solving any technical problems, the Contractor shall supply Manufacturer's factory technical representation and diagnostic equipment at no cost to the Owner, until resolution of those defined problems. Where appropriate, the Contractor shall bring the Systems on-line in their basic state (i.e., alarm reporting, facility code access control, etc.) It is the responsibility of the Owner to provide the specific database information that will be utilized for initial system programming.
- B. Properly ground each piece of electronic equipment prior to applying power. Properly ground all shielded wire shields to the appropriate earth ground at the hub end only, not at the remote or device end.
- C. Use a start-up sequence that incrementally brings each portion of the system on-line in a logical order that incorporates checking individual elements before proceeding to subsequent elements until the entire system is operational. The basic steps should include:
  - 1. Establish ground planes at the equipment rooms and hub end of the systems as specified in Division 26.
  - 2. Disconnect power, connect the first device, reconnect power, and verify operational correctness. Repeat until the entire system is verified and operational.

### 3.17 PREPARATION FOR ACCEPTANCE (SUBSTANTIAL COMPLETION)

- A. All systems, equipment, and devices shall be in full and proper adjustment and operation, and properly labeled and identified.
- B. All materials shall be neat, clean and unmarred, and parts securely attached.
- C. All extra material as specified shall be delivered and stored at the premises as directed.



- D. Test reports of each system and each system's components and As-Built Project Drawings shall be complete and available for inspection and delivery as directed by the Owner.

### 3.18 SYSTEM ACCEPTANCE REQUIREMENTS

- A. Before final acceptance or work, the Contractor shall perform and/or deliver each of the following in the order stated.
- B. The Contractor shall deliver three (3) composite "System Operations and Maintenance" manuals in three-ring binders, sized to hold the material below, plus 50% excess. Each manual shall contain in appropriately tabbed sections:
1. A statement of Guarantee including date of termination and the name and phone number of the persons to be called in the event of equipment failure.
  2. A set of Operating procedures for the overall System that includes all required Owner activities, and that allows for the Owner operation of all attributes and facilities of the System.
  3. A section for each specific type of equipment containing the vendor manuals, instruction sheets, and any related literature that came in the original shipping container for that piece of equipment. Include all warranty cards.
- C. Testing:
1. The Contractor shall perform all tests required by Division 28 and those submitted as part of this Section.
  2. The Contractor shall activate all devices for proper system operation, including supervisory and trouble circuit tests. Similarly, audible alarms will not be activated except on a one-time, coordinated basis, to check the actual sounding devices.
  3. A test report for each piece of equipment shall be prepared by the Contractor and submitted to the Owner. This report shall include a complete listing of every device, the date it was tested, by whom and the results. The final test reports shall indicate that every device tested successfully. Failure to completely test and document the tests will result in a delay of final testing and acceptance.
- D. As-Built Drawings:
1. After completion of all the tests listed above, and prior to the final acceptance test, The Contractor shall submit the complete As-Built drawings as identified in PART 1 – PROJECT RECORD DRAWINGS.
  2. The final As-Built Drawings shall consist on one set of reproducible prints, two (2) sets of Point-to-Point Detail Drawings, Equipment Schedules, and the complete detailed technical data that was shipped by the manufacturer with all installed equipment.
- E. Final Acceptance Test: The Final Acceptance Test shall demonstrate the installed and activated System's performance and compliance with System Specifications. However, before this testing can begin the following must have received and reviewed by the Owner.
1. System Operations and Maintenance Manuals
  2. System Test Reports
  3. As-Built Drawings

### 3.19 NOTICE OF COMPLETION

- A. When the Final System Acceptance Requirements described above including the Final Acceptance Test described above have been satisfactorily completed. The Owner / Architect shall issue a Letter of Completion to the Contractor indicating the date of such completion. The Notice of Completion shall be recorded by the Contractor upon receipt of the Owner / Architect completion letter. This date of record shall be the start of the warranty period.

END OF SECTION

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SECTION 28 05 05

ELECTRONIC SAFETY AND SECURITY ALTERATIONS PROJECT PROCEDURES

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Inspection and service of existing equipment and materials to remain or be reused.
- B. Handling of equipment and materials to be abandoned.
- C. Handling of equipment and materials to be removed.

1.2 QUALITY ASSURANCE

- A. Coordination with the Contractor prior to the disconnection or shutdown of existing equipment, or to the modification of existing operational systems.

1.3 CONTRACT DRAWINGS

- A. There exists the possibility that there are existing conditions and devices which are affected by the work indicated on the drawings and called for in the specifications (project manual) which do not appear on the drawings. It is the Contractors responsibility to visit the site and determine all of the existing conditions and to take these existing conditions into consideration when making and presenting a proposal to as to have a complete proposal.

PART 2 - PRODUCTS

2.1 MATERIALS AND EQUIPMENT

- A. Material used to upgrade and repair existing equipment shall conform to that specified.
- B. Material used to upgrade and repair existing equipment shall not void existing warranties or listings of the equipment to be upgraded or repaired.
- C. Material used to upgrade and repair existing equipment shall be new and shall be of the same manufacturer of the existing equipment, shall be acquired through the existing original equipment manufacturer's approved distribution channels, shall have manufacturer's warranties for the new material being used, and shall be listed for the use intended.

PART 3 - EXECUTION

3.1 INSPECTION

- A. Existing materials and equipment indicated on the drawings or in the specifications to be reused shall be inspected for damaged or missing parts. Notify the Architect/Engineer, in writing, accordingly.
- B. If using materials specified or shown on the drawing voids or diminishes the warranty or operation of remaining equipment or systems, the Contractor shall notify the Architect/Engineer, in writing.
- C. Verify field measurements and circuiting arrangements.
- D. Verify that abandoned wiring and equipment serve only abandoned facilities.
- E. Demolition Drawings are based on casual field observation and existing record documents. Report discrepancies to Architect before disturbing existing installation.

3.2 APPLICATION

- A. Existing materials and equipment indicated on the drawings or in the specification to be reused shall be cleaned and reconditioned, including tightening of feeder and bus bar lugs prior to

ELECTRONIC SAFETY AND SECURITY ALTERATIONS PROJECT PROCEDURES

installation and reuse in the modified system.

- B. Material and equipment removed that is not to be salvaged for Owner's use or for reuse on the project shall become the property of the Contractor and shall be removed from the site.
- C. Prior to start of construction, Contractor shall walk areas to be renovated with Owner to identify and document items to be salvaged for Owner's use.
- D. Material or equipment salvaged for Owner's use shall be carefully handled and stored where directed by the Owner.
- E. Materials and equipment not indicated to be removed or abandoned shall be reconnected to the new system.
- F. Clean and repair existing materials and equipment that remain or are to be reused.

### 3.3 SEQUENCING AND SCHEDULING

- A. Coordinate utility service outages with Architect and Owner.
- B. 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.
- C. Remove and replace existing conduit, wiring, outlets, devices, and appurtenances as occasioned by new or remodeled construction. Re-establish service to devices that may be interrupted by remodeled construction.
- D. Disconnect communication systems in walls, floors and ceilings scheduled for removal. When outlets are removed, wire shall be pulled out of the conduit back to the nearest remaining box or cabinet.
  - 1. Remove exposed conduit that has been abandoned.
  - 2. Cap conduit beyond the finish line.
- E. Remove equipment, systems, conductors, wiring, raceways, etc. abandoned or not required for existing or new systems. Coordinate with Architect/Owner for salvage by Owner.
- F. Existing Fire Alarm System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify Owner and local fire service at least 24 hours before partially or completely disabling system. Minimize outage duration. Make temporary connections to maintain service in areas adjacent to work area.
- G. Existing Security System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.
- H. Existing Video Surveillance System: Maintain existing system in service. Disable system only to make switchovers and connections. Notify the Owner at least 24 hours before partially or completely disabling system. Minimize outage duration.

### 3.4 DEMOLITION AND EXTENSION OF EXISTING SAFETY AND SECURITY WORK

- A. The Contractor shall modify, remove, and/or relocate all materials and items so indicated on the drawings or required by the installation of new facilities. All removals and/or dismantling shall be conducted in a manner as to produce maximum salvage. Salvage materials shall remain the property of the Owner, and shall be delivered to such destination as directed by the Owner's representative unless they are not wanted, then it will be the responsibility of this Contractor to remove such items and properly dispose of them. Materials and/or items scheduled for relocation and which are damaged during dismantling or reassembly operations shall be repaired and restored to good operative condition. The Contractor may, at his discretion, and upon approval of the Owner's representative substitute new materials and/or items of like design and quality in lieu of materials and/or items to be relocated.

- B. All items to be relocated shall be carefully removed in reverse to original assembly or placement and protected until relocated. The Contractor shall clean and repair and provide all new materials, fittings, and appurtenances required to complete the relocations and to restore them to good operative order. All relocations shall be performed by workmen skilled in the work and in accordance with standard practice of the trades involved.
- C. When items scheduled for relocation and/or reuse are found to be in damaged condition before work has been started on dismantling, the Contractor shall call the attention of the Owner's representative to such items and receive further instructions before removal. Items damaged in repositioning operations are the contractor's responsibility and shall be repaired or replaced by the contractor as approved by the owner's representative, at no additional cost to the Owner.
- D. Conduit and wiring to items to be removed, salvaged, or relocated shall be removed to points indicated on the drawings, specified, or acceptable to the Owner's representative. Conduit and wiring not scheduled for reuse shall be removed to the points at which reuse is to be continued or service is to remain. Such services shall be sealed, capped, or otherwise tied-off or disconnected in a safe manner acceptable to the Construction Inspector. All disconnections or connections into the existing facilities shall be done in such a manner as to result in minimum interruption of services to adjacent occupied areas. Services to existing areas or facilities that must remain in operation during the construction period shall not be interrupted without prior specific approval of the Owner's representative hereinbefore specified.
- E. 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.
- F. Disconnect and remove communication devices and equipment serving utilization equipment that has been removed.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing communication installations that remain active. Modify installation or provide access panel as appropriate.
- I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

### 3.5 PROTECTION OF THE WORK

- A. Provide adequate temporary support and auxiliary structure as necessary to ensure structural value or integrity of affected portion of work.
- B. Provide devices and methods to protect other portions of work from damage.
- C. Execute fitting and adjustment of products to provide a finished installation to comply with specified products, functions, tolerances and finishes.
- D. Repairs, equipment replacements, and corrections to special systems due to damage caused by contractor:
  - 1. For each special system, a manufacturer certified contractor and certified technicians shall perform corrective measures to each system component that was functional prior to demolition and renovation and found defective or non-functional within 14-days prior to estimated date of substantial completion.
  - 2. Corrective measures to the special systems to correct components of the special systems found damaged by the contractor shall be completed to the satisfaction of the Owner and Architect prior to acceptance of substantial completion at no additional cost to the Owner.

### 3.6 TESTING AND CORRECTIVE MEASURES FOR DAMAGE DURING CONSTRUCTION IN EXISTING LOW VOLTAGE SYSTEMS

- A. Pre-construction testing of existing low voltage systems:
  - 1. Provide a complete operational test of the following systems prior to demolition and renovation. Verify operation of each circuit, device, panel, console, distribution

#### ELECTRONIC SAFETY AND SECURITY ALTERATIONS PROJECT PROCEDURES

equipment, and associated accessories. Test shall be preformed by a contractor and technicians, each certified by the respective manufacturer of the existing special system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:

- a. Security Access Control System
- b. Video Surveillance System
- c. Fire Alarm and Detection System

2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and individuals performing the tests. Provide the written report within 14 days of notice to proceed and prior to any demolition or renovation work.

B. Substantial completion testing of existing special systems:

1. Provide complete operational test of the following systems within 14-days prior to estimated date of substantial completion. Verify operation of each circuit, device, panel, console, distribution equipment, and associated accessories. Test shall be preformed by a contractor and technicians each certified by the respective manufacturer of the existing system to perform test, programming, and repairs to the respective manufacturer's system. Testing of the existing system shall include all areas served by the existing system including but not limited to the main campus, remote buildings, and temporary buildings:
  - a. Security Access Control System
  - b. Video Surveillance System
  - c. Fire Alarm and Detection System
2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. Include in the written report evidence of current certification by the respective manufacturer for the contractor and each individual performing the tests. Provide the written report within 14 days of expected date for substantial completion.

END OF SECTION

SECTION 28 05 07

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Prepare submittals as required by Division 1 and as outlined below.
- B. Submit product data shop drawings only for the following and for items specifically requested elsewhere in the Contract Drawings and Specifications. Architect / Engineer reserves the right to refuse shop drawings not requested for review and to imply that materials shall be provided as specified without exception.
- C. The term submittal, as used herein, refers to all:
  - 1. Shop Drawings
  - 2. Coordination Drawings
  - 3. Product data
- D. Submittals shall be prepared and produced for:
  - 1. Distribution as specified
  - 2. Inclusion in the Operating and Maintenance Manual, as specified, in the related section

1.2 SHOP DRAWINGS

- A. Present drawings in a clear and thorough manner. Identify details by reference to sheet and detail, schedule, or room numbers shown on Contract Drawings.
- B. Show all dimensions of each item of equipment on a single composite Shop Drawing. Do not submit a series of drawings of components.
- C. Identify field dimensions; show relation to adjacent or critical features or work or products.

1.3 COORDINATION DRAWINGS

- A. Present in a clear and thorough manner. Title each drawing with project name. Identify each element of drawings by reference to sheet number and detail, or room number of contract documents. Minimum drawing scale: 1/4"=1'-0".
- B. Prepare coordination drawings to coordinate installations for efficient use of available space, for proper sequence of installation and to resolve conflicts. Coordinate with work specified in other sections and other divisions of the specifications.
- C. For each room containing ESS equipment and each rack with ESS equipment, submit plan and elevation drawings. Show:
  - 1. Actual ESS equipment and components to be furnished.
  - 2. NEC working space and NEC access to NEC working space.
  - 3. Relationship to other equipment and components and openings, doors and obstructions
  - 4. Rack location and dimensions
- D. Identify field dimensions. Show relation to adjacent or critical features of work or products.
- E. Verify location of ESS station devices and other work specified in this Division.
  - 1. Coordinate with drawing details, site conditions and millwork shop drawings prior to installation.
  - 2. Where required for clarification, submit shop drawings prior to rough-in and fabrication.
- F. Submit shop drawings in plan, elevation and sections, showing outlets and other devices in casework, cabinetwork and built-in furniture.

1.4 PRODUCT DATA

SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- A. All product options specified shall be indicated on the product data submittal. All options listed on the standard product printed data not clearly identified as not part of the product data submitted shall become part of the Contract and shall be provided.
- B. Mark each copy of standard printed data to identify pertinent products, referenced to specification section and article number.
- C. Show reference standards, performance characteristics and capacities; wiring and piping diagrams and controls; component parts; finishes; dimensions and required clearances.
- D. Modify manufacturer's standard schematic drawings and diagrams to supplement standard information and to provide information specifically applicable to the work. Delete information not applicable.
- E. Mark up a copy of the specifications for the product to indicate a) acknowledgement of the specification requirement (Comply), or b) acknowledgement that the particular specification requirement does not apply to this specific project (Not Applicable) or, c) acknowledgement that the specification requirement cannot be made or that a variance is being submitted for review to the Architect / Engineer/Owner (Does Not Comply, Explanation:)

#### 1.5 MANUFACTURERS INSTRUCTIONS

- A. Submit Manufacturer's instructions for storage, preparation, assembly, installation, start-up and adjusting.

#### 1.6 CONTRACTOR RESPONSIBILITIES

- A. Review submittals prior to transmittal.
- B. Determine and verify:
  - 1. Field measurements
  - 2. Field construction criteria
  - 3. Manufacturer's catalog numbers
  - 4. Conformance with requirements of Contract Documents
- C. Coordinate submittals with requirements of the work and of the Contract Documents.
- D. Notify the Architect / Engineer in writing at time of submission of any deviations in the submittals from requirements of the Contract Documents.
- E. Do not fabricate products, or begin work for which submittals are specified, until such submittals have been produced and bear contractor's stamp. Do not fabricate products or begin work scheduled to have submittals reviewed until return of reviewed submittals with Architect / Engineer's acceptance.
- F. Contractor's responsibility for errors and omissions in submittals is not relieved whether Architect / Engineer reviews submittals or not.
- G. Contractor's responsibility for deviations in submittals from requirements of Contract Documents is not relieved whether Architect / Engineer reviews submittals or not, unless Architect / Engineer gives written acceptance of the specific deviations on reviewed documents.
- H. Submittals shall show sufficient data to indicate complete compliance with Contract Documents:
  - 1. Proper sizes and capacities
  - 2. That the item will fit in the available space in a manner that will allow proper service
  - 3. Construction methods, materials and finishes
- I. Schedule submissions at least 15 days before date reviewed submittals will be needed.

#### 1.7 SUBMISSION REQUIREMENTS

- A. Make submittals promptly in accordance with approved schedule, and in such sequence as to cause no delay in the Project or in the work of any other Contractor.

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA



- B. Number of submittals required:
  - 1. Shop Drawings and Coordination Drawings: Submit four opaque reproductions.
  - 2. Product Data: Submit the number of copies the contractor requires, plus those to be retained by the Architect / Engineer.
- C. Accompany submittals with transmittal letter, in duplicate, containing:
  - 1. Date
  - 2. Project title and number
  - 3. Contractor's name, address and telephone number
  - 4. The number of each Shop Drawing, Project Datum and Sample submitted
  - 5. Other pertinent data
- D. Submittals shall include:
  - 1. The date of submission
  - 2. The project title and number
  - 3. Contract Identification
  - 4. The names of:
    - a. Contractor
    - b. Subcontractor
    - c. Supplier
    - d. Manufacturer
  - 5. Identification of the product
  - 6. Field dimensions, clearly identified as such
  - 7. Relation to adjacent or critical features of the work or materials
  - 8. Applicable standards, such as ASTM or federal specifications numbers
  - 9. Identification of deviations from contract documents
  - 10. Suitable blank space for General Contractor and Architect / Engineer stamps
  - 11. Contractor's signed and dated Stamp of Approval
- E. Coordinate submittals into logical groupings to facilitate interrelation of the several items.
  - 1. Finishes which involve Architect / Engineer selection of colors, textures or patterns
  - 2. Associated items requiring correlation for efficient function or for installation

#### 1.8 SUBMITTAL SPECIFICATION INFORMATION

- A. Every submittal document shall bear the following information as used in the project manual:
  - 1. The related specification section number
  - 2. The exact specification section title
- B. Submittals delivered to the Architect / Engineer without the specified information will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.9 RESUBMISSION REQUIREMENTS

- A. Make resubmittals under procedures specified for initial submittals.
  - 1. Indicate that the document or sample is a resubmittal
  - 2. Identify changes made since previous submittals
- B. Indicate any changes which have been made other than those requested by the Architect / Engineer.

#### 1.10 CONTRACTOR'S STAMP OF APPROVAL

- A. Contractor shall stamp and sign each document certifying to the review of products, field measurements and field construction criteria, and coordination of the information within the submittal with requirements of the work and of Contract Documents.
- B. Contractor's stamp of approval on any submittal shall constitute a representation to Owner and Architect / Engineer that Contractor has either determined and verified all quantities, dimensions, field construction criteria, materials, catalog numbers, and similar data or assumes full responsibility for doing so, and that Contractor has reviewed or coordinated each submittal with the requirements of the work and the Contract Documents.

#### SHOP DRAWINGS, COORDINATION DRAWINGS & PRODUCT DATA

- C. Do not deliver any submittals to the Architect / Engineer that do not bear the Contractor's stamp of approval and signature.
- D. Submittals delivered to the Architect / Engineer without Contractor's stamp of approval and signature will not be processed. The Contractor shall bear the risk of all delays, as if no submittal had been delivered.

#### 1.11 ARCHITECT / ENGINEER REVIEW OF IDENTIFIED SUBMITTALS

- A. The Architect / Engineer will:
  - 1. Review identified submittals with reasonable promptness and in accordance with schedule. Specific equipment submittals that may be required to be expedited shall be submitted separately without other submittal items not requiring the same prompt attention.
  - 2. Affix stamp and initials or signature, and indicate requirements for resubmittal or approval of submittal
  - 3. Return submittals to Contractor for distribution or for resubmission
- B. Review of submittals will not extend to design data reflected in submittals that is peculiarly within the special expertise of the Contractor or any party dealing directly with the Contractor.
- C. Architect / Engineer's review is only for conformance with the design concept of the project and for compliance with the information given in the contract.
  - 1. The review shall not extend to means, methods, sequences, techniques or procedures of construction or to safety precautions or programs incident thereto.
  - 2. The review shall not extend to review of quantities, dimensions, weights or gauges, fabrication processes or coordination with the work of other trades.
- D. The review and approval of a separate item as such will not indicate approval of the assembly in which the item functions.

#### 1.12 SUBSTITUTIONS

- A. Do not make requests for substitution employing the procedures of this Section.
- B. The procedure for making a formal request for substitution is specified in Division 01.

### PART 2 - PRODUCTS - NOT USED.

### PART 3 - EXECUTION

#### 3.1 SHOP DRAWINGS AND PRODUCT DATA

- A. Submittals shall not be combined or bound together with any other material submittal.
- B. Submit individually bound shop drawings and product data for the following when specified or provided:
  - 1. Low Voltage Wire
  - 2. Electronic Access Control and Intrusion Detection
  - 3. Electronic Surveillance
  - 4. Fire Detection and Alarm

#### 3.2 COORDINATION DRAWINGS

- A. Submit coordination drawings as specified.

END OF SECTION

SECTION 28 05 10

CONTRACT QUALITY CONTROL

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Contract quality control including workmanship, manufacturer's instructions, mock-ups and demonstrations.

1.2 QUALITY CONTROL PROGRAM

- A. Maintain quality control over supervision, subcontractors, suppliers, manufacturers, products, services, site conditions and workmanship to produce work in accordance with contract documents.

1.3 WORKMANSHIP

- A. Comply with industry standards except when more restrictive tolerances or specified requirements indicate more rigid standards or more precise workmanship.
- B. Perform work by persons qualified to produce workmanship of specified quality.
- C. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, and racking. Under no conditions shall material or equipment be suspended from structural bridging.
- D. Provide finishes to match approved samples; all exposed finishes shall be approved by the Architect / Engineer. Submit color samples as required.

1.4 MANUFACTURER'S INSTRUCTIONS

- A. Comply with instructions in full detail, including each step in sequence.
- B. Should instruction conflict with Contract Documents, request clarification from Architect / Engineer before proceeding.

1.5 MANUFACTURER'S CERTIFICATES

- A. When required in individual Specification Sections, submit manufacturer's certificate in duplicate, certifying that products meet or exceed specified requirements.

1.6 MANUFACTURER'S FIELD SERVICES

- A. When required in individual Specification Sections, manufacturer shall provide a manufacturer's qualified personnel to observe:
  - 1. Field conditions.
  - 2. Condition of installation.
  - 3. Quality of workmanship.
  - 4. Start-up of equipment.
  - 5. Testing and adjusting of equipment.
- B. Manufacturer's qualified personnel shall make written report of observations and recommendations to Architect / Engineer.

1.7 MOCK UPS

- A. Assemble and erect the specified equipment and products complete, with specified anchorage and support devices, seals and finishes.
- B. Do not proceed with any work involving a mock-up, until the related mock up has been approved in writing.

CONTRACT QUALITY CONTROL

- C. Acceptable mock-ups in place shall be retained in the completed work where possible.
- D. Perform tests and submit results as specified.

1.8 SCHEDULING OF MOCK-UPS

- A. Schedule demonstration and observation of mock-ups, in phases, with Architect / Engineer.
  - 1. Rough-in
  - 2. Finish with all appurtenances in place
  - 3. Demonstrations

PART 2 - PRODUCTS

2.1 REFERENCE APPLICABLE SPECIFICATION SECTIONS

PART 3 - EXECUTION

3.1 ADJUSTMENTS AND MODIFICATIONS

- A. Contractor shall provide all adjustments and modifications as requested by the manufacturer's qualified personnel at no additional cost to Owner.

3.2 MOCK-UPS

- A. Mock up a typical classroom, science lab of each type, and computer lab with all wiring devices, cover plates, rough-in boxes, conduits, etc. provide all conductors from all wiring devices to above ceiling space to demonstrate conduit routing and conductor fill.

END OF SECTION

SECTION 28 05 50

FIRESTOPS

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide firestop as required, and as specified. Refer to Architectural drawings for all fire and smoke rated partitions, walls, floors, etc.
- B. Types: Firestop required for the project includes smokestop.

1.2 QUALITY ASSURANCE

- A. UL Label: Firestops shall be UL labeled.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Nelson.
- B. 3M (Minnesota Mining Manufacturing).
- C. Hilti
- D. Specified Technologies, Inc.

2.2 MATERIAL AND COMPONENTS

- A. General: Except as otherwise indicated, provide firestop manufacturer's standard materials and components as indicated by published product information, designed and constructed as recommended by the manufacturer, and as required for installation.

2.3 FIRESTOP

- A. Conduits: Provide a soft, permanently flexible sealant for 1-1/2 to 2 hour rated fireproofing for steel conduits (up to 4" diameter).
- B. Low Voltage Cables, Fiber Optic Cable and Innerduct: Provide Specified Technologies, Inc. EZ-Path single, double, or triple pathways as required.

PART 3 - EXECUTION

3.1 INSTALLATION OF FIRESTOPS

- A. General: Install firestops in accordance with the manufacturer's installation instructions and industry practices to ensure that the firestops comply with requirements. Comply with UL and NFPA standards for the installation of firestops.

END OF SECTION

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SECTION 28 46 02

EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

PART 1 - GENERAL

1.1 WORK INCLUDED

- A. Provide all detailed engineering, documentation, materials and devices, installation, calibration, software programming and check-out necessary for a complete and fully operational fire detection and alarm system in accordance with the full intent and meaning of the drawings and specifications including, but not limited to, the following:
  - 1. Supply, install and connect all hardware necessary to provide a complete and operational fire detection and alarm system.
  - 2. Supply, install and wire all field hardware, power supplies, power circuits, alarm initiating devices, audible and visual alarm devices, auxiliary control relays, signal initiating and signaling devices, conduits, wires, fittings and all accessories required for the system to perform as specified as required. Use and expand the existing fire alarm control panel.
  - 3. Supply, install, debug and test all software required to provide all software functions described in accordance with the full intent and meaning of the drawings and specifications.
  - 4. Coordinate the work specified under this Section with other trades and contractors to assure a complete and fully operational system.
- B. The intent of fire detection and alarm system work is specified in this section and indicated on the drawings. The installing contractor shall design and provide a complete system, meeting the requirement of this section. The Contractor shall provide all fire alarm and initiation devices in new and renovated areas required for a complete system acceptable to all governing authorities. Provide proper spacing and coverage of all devices.

1.2 RELATED SECTIONS

- A. Divisions 22, 23 and 26
- B. Fire Suppression Systems
- C. Elevators
- D. Food Service

1.3 CODES / STANDARDS / REFERENCES (LATEST EDITIONS)

- A. National Fire Protection Association (NFPA):
  - 1. NFPA1 Fire Code
  - 2. NFPA 13 Systems, Installation
  - 3. NFPA 17 Dry Chemical Extinguishing Systems
  - 4. NFPA 70 National Electrical Code
  - 5. NFPA 72 National Fire Alarm and Signaling Code.
  - 6. NFPA 80 Fire Doors and Fire Windows
  - 7. NFPA 90A Standard for the Installation of Air Conditioning and Ventilating Systems.
  - 8. NFPA 92A Smoke Control Systems
  - 9. NFPA 101 Life Safety code.
  - 10. NFPA 105 Smoke Control Door Assemblies
  - 11. NFPA 1221 Standard for the Installation, Maintenance and Use of Emergency Services Communications Systems.
  - 12. NFPA 2001 Fire Extinguishing Systems, Clean Agent
- B. UL: Underwriters Laboratories, Inc.
  - 1. 217 Single and Multiple Station Smoke Detectors.
  - 2. 268 Smoke Detectors for Fire Protective Signaling Services.
  - 3. 864 Control Units for Fire Protective Signaling Services.
  - 4. 864 Transient protection

EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

5. 1480 Speakers for Fire Protective Signaling Systems
  6. UL Fire Protection Equipment Directory.
  7. UL Electrical Construction Materials Directory.
- C. Factory Mutual P7825 Approval Guide
- D. American National Standards Institute (ANSI).
- E. National Electrical Manufacturer's Association (NEMA).
- F. Institute of Electrical and Electronic Engineers (IEEE).
- G. Electronic Industries Association (EIA-232-C): Interface between Data Terminal Equipment and Data Communication Equipment Employing Serial Binary Data Interchange.
- H. Requirements of American Disabilities Act (Public Law 101-336).
- I. Local Accessibility Standards, Codes, and Ordinances
- J. State Fire Marshall or Requirements of Local Authorities having Jurisdiction
- K. State Insurance Code.
- L. National Building Code.
- M. International Building and Fire Code adopted by Local Authority Having Jurisdiction
- N. Uniform Building Code.
- O. Local & State Building Codes.
- P. In addition the above requirements, comply with all local codes. Where discrepancies exist between codes, drawings or specifications, the more stringent requirement shall prevail. Installation shall be subject to approval, inspection and test of applicable regulatory agencies.

#### 1.4 MANUFACTURER'S, PLANNER'S AND INSTALLER'S QUALIFICATIONS

- A. The manufacturer shall regularly and presently produce, as the manufacturer's principle products, the equipment and material of the type and design specified for this project, and shall have manufactured the item for at least 5 years. All components of the system shall be UL compatible with the existing main fire alarm control panel. Manufacturer of all components shall match existing manufacturers of similar or same type components unless otherwise specified or noted on the drawings.
- B. The installing contractor shall have been actively engaged in the business of designing, selling, installing, and servicing fire alarm systems for at least ten (10) years.
- C. The entire Fire Detection and Alarm System shall be installed by a factory authorized representative of the existing main fire alarm control panel and certified by the manufacturer to distribute, sell, and install the specified fire alarm and smoke detection system. Include all components, elements, and testing and acceptance procedures.
- D. If the submitted system is being supplied by an authorized distributor of the equipment manufacturer, the distributor shall have been actively engaged in the sale, installation and service of the type of system proposed for this project for a minimum of 10 years.
- E. Any proposed installer who cannot show evidence of such qualifications may be rejected. The services of a technician provided and certified by the equipment manufacturer shall be provided to supervise the installation and tests of the system.
- F. Furnish evidence there is an experienced and effective service organization, which carries a stock of repair parts for the system to be furnished.



- G. The installing contractor shall be licensed by the State Fire Marshall to design, sell, install, and service fire alarm systems as required by the State Insurance Code.
- H. The installing contractor shall have on his staff a minimum of two (2) Fire Alarm Planning Superintendent (APS) licensed by the State Fire Marshall's office for such purpose and under whose supervision installation, final connections, and check out will take place as required by the State Insurance Code.
- I. The APS shall be a certified NICET Level III state licensed fire alarm planner under whose supervision system design shall take place. In lieu of a NICET certified state licensed fire alarm planner, the contractor or supplier may provide design supervision by a registered professional engineer, who regularly engages in the design of fire alarm systems.
- J. The installing contractor shall provide 24-hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- K. Material shall be new and in perfect condition when installed.
- L. Electrical or electronic equipment provided under this Division which has been damaged, exposed to weather, or is, in the opinion of the Architect/Engineer otherwise unsuitable because of improper fabrication, storage, or installation, shall be removed and replaced with new equipment, at no additional cost to the owner.

#### 1.5 COORDINATION

- A. It shall be the responsibility of the installing contractor to coordinate all requirements surrounding installation of the fire alarm system with all other trades.

#### 1.6 DEFINITIONS

- A. General: Wherever mentioned in this specification or on the drawings, the equipment, devices and functions shall be defined as follows:
  - 1. Alarm Signal: A signal, which signifies a state of emergency requiring immediate action and immediate notification of the Fire Department. These are signals such as:
    - a. The operation of a manual station.
    - b. The operation of a fire suppression system switch.
  - 2. Pre-Alarm Signal: A signal, which indicates a detection device, has operated. These signals require an immediate response, but do not require immediate notification of the Fire Department.
  - 3. Supervisory Signal: A signal, which signifies the impairment of fire protection system, which may prevent its normal operation.
  - 4. Trouble Signal: A signal, which indicates that a fault, such as an open circuit or ground, has occurred in the system.
  - 5. Alarm Zone: An alarm initiating device or combination of devices connected to a single alarm initiating device circuit.
  - 6. Pre-Alarm Zone: A detector or group of detectors connected to a single detector circuit, which can send an alarm to the central control panel.
  - 7. Supervision Zone: A supervisory signal initiating device or combination of such devices connected to a single supervisory signal circuit.
  - 8. Communication Zone: A fire alarm indicating device or series of devices arranged to visually and/or audibly indicate a fire alarm signal.

#### 1.7 SUBMITTALS

- A. Before the shop drawings are submitted to Architect / Engineer, submit drawings to the Authority Having Jurisdiction for approval. All approvals shall be noted on the drawings or by letter from the Authority Having Jurisdiction. Submit copies of the Authority Having Jurisdiction approved shop drawings to the Architect for review.
- B. Fire alarm submittal shall be bound and separate from all other submittals. The installing contractor and/or equipment supplier shall provide complete and detailed shop drawings and include:
  - 1. Provide a complete written, item-by-item, line-by-line, specification review stating

#### EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

- compliance or deviation in full description.
2. Complete point-to-point wiring diagrams of new equipment.
3. Complete floor plan drawings locating all new system devices and existing panels used for expansion.
4. Complete system bill of material.
5. Detailed system operational description. Any specification differences and deviations shall be clearly noted and marked.
6. Provide a complete description of system operation.
7. Manufacturer's installation instruction.
8. Bound form with contractor's name, supplier's name, project name, state fire alarm license, Fire Alarm Planning Superintendent license and all Technician(s) license adequately identified.
9. Submittal sheets sequentially numbered with the format: sheet number of number total. For example: 1 of 3.
10. Complete set of manufacturer's operating instructions, circuit diagrams and the information necessary for proper installation, operation and maintenance.
11. Field and factory wiring diagrams of all new systems and for typical devices showing all connections with all terminals and interconnections identified.
12. Complete schematic circuit diagrams for all new equipment, including panel modules.
13. Floor plan drawings including all existing main and new panel and device locations, conduit sizes between devices and panels; number, size and type of conductors between devices and panels; walls, doors and graphic room numbers; exact power requirements and conduit routing with the location of all junction boxes and exact locations of devices and equipment. Submit a floor plan drawing circuiting/zoning shall be identified on the drawings.
14. Complete wiring, routing, and schematic diagrams, software descriptions, and details required to demonstrate that the system has been coordinated and will function as a system.
15. Manufacturers catalog cut sheets shall be provide for each piece of equipment with the appropriate model or part number highlighted in cases where multiple model numbers or part numbers are shown.
16. Detailed list of all hardware components, which are included.
17. Installation details for each type of field mounted device installed under this contract.
18. Point-to-point termination schedules with cable identification numbers and terminal strip numbers.
19. New fire detection and alarm system's panel configuration complete with peripheral devices, batteries, power supplies, and interconnection diagrams.
20. Submit a riser diagram of trunk wiring and device-to-device wiring and device to fire alarm control panel wiring. Riser shall show:
  - a. Conduit sizes and types.
  - b. Number, size and type of conductors.
  - c. Fire detection and alarm devices arranged in the required circuiting/zoning, as defined in the specifications and on the drawing.
  - d. Battery calculations to show compliance with the requirements of the specifications for both alarm and supervisory mode.
21. Indicate visual alarm device candela setting required for coverage.
22. Sample of proposed graphic/text annunciation.

#### 1.8 OPERATION AND MAINTENANCE MANUALS

- A. Submit complete sets of operation and maintenance manuals. Manual, less as-builts, and sign-off sheets, shall be provided upon completion of the work. Approval of the manual will be required prior to substantial completion.
- B. The Operation and Maintenance Manual shall consist of the following:
  1. The manual shall include the names, addresses and telephone numbers of each Contractor installing products, and of the nearest service representative for each product. The manual shall have a Table of Contents and tab sheets. Update manuals to include modifications made during installation, checkout and acceptance. The manual shall include the sections described in the following paragraphs.
  2. The Functional Design Section shall identify the operational requirements for the system and explain the theory of operation, design philosophy, and specific functions. Hardware and software functions, interfaces, and requirements shall be provided for system

#### EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

- operating modes.
3. The Hardware Section shall describe equipment provided, including general description and specifications, installation and checkout procedure, electrical schematics and layout drawings. Alignment and calibration procedures, manufacturer's repair parts list indicating source of supply, interface definition, signal identification and wiring diagrams. Also, include a complete parts list of all components as well as a list of recommended spare parts. The spare parts list shall include, for each item, the manufacturer's name, the model of the part, and serial number, if appropriate, and a physical and electrical description of the part.
  4. The Software Section shall describe programming and testing, starting with a system overview and proceeding to a detailed description of each software module, to instruct the user on programming or reprogramming any portion of the system and other information necessary to enable proper system usage.
  5. The Operation Section shall provide instructions for operation of the system, including system start-up procedures, use of system and applications software, alarm presentation (where applicable), failure and recovery procedures, preventive maintenance schedule, parameter schedules and sequence definition, and system access requirements.
  6. The Maintenance Section shall provide descriptions of maintenance for equipment including inspection, periodic preventive maintenance, fault diagnosis, and repair or replacement of defective components.
  7. The Shop Drawings section shall include copies of all approved shop drawings and submittal materials updated to "AS BUILT".

#### 1.9 AS-BUILT DRAWINGS

- A. Prepare and submit detailed "As-Built" drawings. The drawings shall include certified test of the system, testing and acceptance sign-off sheets, and other items specified elsewhere to be performed after initial submission of operation and maintenance manuals, complete wiring diagrams showing connections between all devices and equipment, both factory and field wired. Include a riser diagram and drawings showing the as built location of all devices and equipment. The drawings shall show the system as installed, including all deviations from both the project drawings and the approved shop drawings. The drawings shall be prepared on uniform sized sheets, the same size as the project drawings. The plan drawings shall be 11x17 inch and inserted in the specified Operations and Maintenance Manuals. Provide electronic copies in PDF and Autocad.dwg format.

#### 1.10 WARRANTY

- A. All new fire alarm devices, new panels, new equipment and new accessories, including labor and material, shall be free from defects in workmanship and materials, under normal use and service, for a period of one year from the date of substantial completion. Any equipment or workmanship shown to be defective shall be repaired, replaced or adjusted during normal working hours at no cost to the owner within 4-hour notification.
- B. Repair services and replacement parts for the system to be furnished under this Contract shall be available for a period of ten years after the date of final acceptance. Service during the warranty period shall be provided within four hours after notification and all repairs shall be corrected within 24 hours after notification throughout the warranty specified in this section.
- C. The installing contractor shall provide 24 hour, 365 days per year emergency service with factory trained, state licensed service technicians.
- D. The equipment manufacturer shall be represented by a local service organization and the name of such shall be furnished to the Owner, Architect, and Engineer.
- E. Provide a certified fire alarm test of the complete system at the end of the warranty period and correct any and all items located in the area of renovation to bring the system to an approved status at no cost to the Owner. Clean all smoke detectors and replace all defective parts within the area of renovation at no cost to the Owner.
- F. Guarantee labor, materials, and equipment provided under this contract against all defects for a period of one year after the date of final acceptance and receipt and approval of "As-Built" drawings and schematics of all equipment.

#### EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

## PART 2 - PRODUCTS

### 2.1 ACCEPTABLE MANUFACTURERS

- A. Manufacturers acceptable contingent upon Products' compliance with the specifications:
1. Match Existing main fire alarm panel manufacturer.
  2. Existing Fire Alarm Panel: Farenhyt IFP-1000 by Silent Knight

### 2.2 SYSTEM DESCRIPTION

- A. System shall be a fully functional fire detection and alarm system, tested and left in first class operating condition. Voice evacuation systems where existing shall have voice alarm notification wherever audible notification is required. Provide full voice evacuation coverage only if required by code and/or local AHJ.
- B. The system shall provide communication with initiating and control devices individually. All of these devices shall be individually annunciated at the fire alarm control panel. Annunciation shall include the following conditions for each point:
1. Alarm
  2. Trouble.
  3. Open
  4. Short
  5. Device missing/failed.
- C. System circuits shall be wired as follows: Initiating device circuit (IDCs) shall be Style B, indicating appliance circuit (IACs) shall be Style Y, and signal line circuit (SLCs) shall be Style 4 as describe in NFPA 72.
- D. The system shall contain independently supervised initiating device circuits. The alarm activation of any initiation circuit shall not prevent the subsequent alarm operation of any other initiation circuit.
- E. There shall be supervisory service initiation device circuits for connection of all sprinkler water flow switches and valves. Device activation shall cause a general alarm at the fire alarm control panel. Each flow and tamper switch shall have an individual address.
- F. There shall be independently supervised and independently fused indicating appliance circuits for all alarm signaling devices. Disarrangement conditions of any circuit shall not affect the operation of other circuits.
- G. Auxiliary manual controls shall be supervised so that an "off normal" position of any switch shall cause an "off normal" system trouble.
- H. The incoming power to the system shall be supervised so that any power failure must be audibly and visually indicated at the fire alarm control panel. A green "power on" LED shall be displayed continuously while incoming power is present at the building fire alarm control panel.
- I. The system batteries shall be supervised so that a low battery condition or disconnection of the battery shall be audibly and visually indicated at the building fire alarm control panel.
- J. The system modules shall be electrically supervised for module placement. Should a module become disconnected, the system trouble indicator shall illuminate, and the audible trouble signal shall sound.
- K. The system shall have provisions for disabling and enabling all circuits individually for maintenance or testing purposes.
- L. The system shall be provided with sufficient battery capacity to operate the entire system upon loss of normal 120 VAC power in a normal or supervisory mode for a period of 24 hours with 20 minutes of alarm operation at the end of this period as a minimum. The system shall automatically transfer to the standby batteries upon power failure. All battery charging and recharging operations shall be automatic. If batteries are fully discharged, the charger shall recharge them back to full

charge in four hours.

- M. All external circuits requiring system operating power shall be 24 VDC and shall be individually fused at the respective fire alarm control panel.
- N. All addressable devices shall have the capability of being disabled or enabled individually from the fire alarm control panel.
- O. A maximum of 90 addressable devices shall be multi-dropped from a single pair of wires. Systems that require factory reprogramming to add or delete devices within the capability of the designed system are unacceptable. Expansion of the designed system shall be accomplished by factory reprogramming.
- P. The communication format to the addressable devices shall be a completely digital poll/response protocol to allow t-tapping of the circuit wiring. A high degree of communication reliability must be obtained by using parity data bit error checking routines for address codes and check sum routines for the data transmission portion of the protocol.
- Q. Each addressable device must be uniquely identified by an address code. The system must verify that proper type device is in place and matches the desired software configuration. All remote or external panels shall have an individual address for monitoring.
- R. Wiring type, distances, survivability, and wiring configuration types shall be approved by the equipment manufacturer. The system shall allow a line distance of up to 2,500 feet to the furthest addressable device on a Style Y circuit. Fire alarm cable shall have an outer jacket insulation color of red. Minimum wire size shall be #18 AWG.
- S. Each panel extender shall have an individual address.

### 2.3 FIRE ALARM CONTROL PANEL (FACP)

- A. Existing to remain.
- B. The fire alarm control panel shall be left with 25% spare initiating point and battery capacity for future use.
- C. New power supplies (if required) shall provide all control panel and peripheral power needs with filtered power as well as unregulated 24VDC power for external audio-visual devices. The audio-visual power shall be increased as needed by adding additional modular expansion power supplies. All power supplies shall be designed to meet UL and NFPA requirements for POWER LIMITED operation on all external signaling lines, including initiating circuits and indicating circuits. Design the system power supplies and power trunk wiring for all annunciation devices required, and to add a minimum of two (2) 110cd visual devices in the future. Individual circuit design loading shall not exceed 70% of power supply and system wiring capacity when including the additional spare capacity for the 110cd visual devices
  - 1. Input power shall be 120VAC 60Hz. The power supply shall provide internal supervised batteries and automatic charger. The power supply shall provide positive and negative ground fault supervision, battery/charger fail condition, and AC power fail indicators. The power supply shall also provide supervision of modular expansion power supplies as may be required.
  - 2. Surge protection shall be integral to the control panels.
  - 3. Each power supply shall be monitored and have an individual address.

### 2.4 DIGITAL FIRE ALARM COMMUNICATOR

- A. Existing to remain.

### 2.5 EMERGENCY VOICE ALARM COMMUNICATION SYSTEM

- A. Existing to remain.
- B. Compatible and UL listed with existing fire alarm system.

## EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

2.6 NEW FIELD DEVICES WHERE REQUIRED

- A. All devices shall be supervised for trouble conditions. The fire alarm control panel shall be capable of displaying the type of trouble condition (open, short, device missing/failed). Should a device fail, it shall not hinder the operation of other system devices.
- B. Visual Signals
  - 1. Strobe lights shall be low profile and operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA and UL 1638 requirements, and 15, 30, or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Provide white with red letters.
  - 2. All wall mounted strobe units installed in student's toilets, gymnasiums, corridors, student locker/dressing rooms shall have a protective cover.
- C. Combination Alarm Signal and High Intensity Visual Signals
  - 1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash. Each unit shall provide a Code 3 Temporal tone. The horn shall be capable of an output of 95dB at 10', and intensity adjusted accordingly for the area of coverage. Electronic Mini-Sounder or horn set on low setting shall be provided in interior rooms 900 square feet or less. Mini-sounder shall not be used in any corridors, mechanical electrical rooms and similar large spaces and areas of high ambient noise level. Provide white with red letters.
  - 2. All wall mounted combination units installed in student toilets, gymnasiums, corridors, student locker/dressing rooms shall have a protective cover
  - 3. The audible emergency alarms shall produce a sound that exceeds the prevailing sound level in the room or space by at least 15 dba or shall exceed any maximum sound level with a duration of 60 seconds by 5 dba, whichever is louder. Sound levels for alarm signals shall not exceed 110 dba at the minimum hearing distance from the audible appliance.
- D. Exterior Audible Signal:
  - 1. Semi-flush mounted, molded of high impact red thermoplastic and listed for weatherproof locations.
- E. Combination Voice Signal and High Intensity Visual Signals (where indicated or required by local AHJ):
  - 1. Strobe lights shall operate on 24 VDC. The strobe light shall be capable of producing 75 candela on axis to comply with ADA requirements, and 15, 30 or 110 candela to comply with UL 1971 requirements. Visual signals in common areas of illumination shall have synchronized flash.
  - 2. All combination units installed in student toilets, gymnasiums, student locker / dressing rooms shall have a protective cover.
  - 3. The visual signal lens housing shall be white with red lettered FIRE or as approved by Architect. The speaker and visual signal shall be mounted to a common white speaker baffle. The visual signal shall flash at a rate of minimum of 1 Hz and maximum of 3 Hz, and shall use a strobe type lamp or other high intensity long life light source. The lamp intensity shall be a minimum of 75 candela.
  - 4. The speaker shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. High output speakers, UL minimum 87dB at 10 feet with speaker taps of .33.66/1.25/2.5 watts. Standard output speakers, UL 75-81 dB at 10 feet with speaker taps of .5/1/1.75/2.75 watts. Capacitor for line supervision.
- F. Ceiling mounted recessed mounted speakers (where indicated or required by local AHJ) shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -30°F. UL minimum 78-87 dB at 10 feet with speaker taps of .25, .5/1.0/2.0 watts. Round, white baffle or 2x2 lay-in grid with UL enclosure, tile bridge supports when recessed in lay-in ceiling tiles (where indicated or required by local AHJ) and capacitor for line supervision.
- G. Surface mounted speakers (where indicated or required by local AHJ) shall be UL 1480 compatible with the control equipment. Unit shall operate within a temperature range of 150°F to -

30°F UL minimum 100 dB at 15 watts at 10 feet. Speaker taps via 7-position selector switch, 25-vol., .48/.94/1.8/7.5/15 watts. Fully enclosed wiring terminals. Capacitor for line supervision.

- H. Manual Pull Station: Addressable pull stations shall contain electronics that communicate the station's status (alarm, normal) to the control panel over two wires which also provide power to the pull station. They shall be manufactured from high impact red Lexan with white lettering. Station shall mechanically latch upon operation and remain so until manually reset by opening with a key common to all system locks. Pull stations shall be double action without glass rods. The front of the station shall be hinged to a back plate assembly and shall be opened with a key to reset the station. The key shall be common with the control panels. The addressable manual station shall have address setting programmed electronically and automatically from the fire alarm control panel. Manual stations shall be designed for semi-flush (surface) mounting on standard electrical box. All pull stations units shall have a protective cover, STI Stopper II #STI-1130 surface mounted cover with local alarm horn. Provide STI, Weather Stopper II #STI3150 for locations where dampness, water or dust is present, except when mounted next to main FACP, staff supervised locations, and remote annunciators.
- I. Intelligent Multi-Criteria Photoelectric Smoke Detectors
1. The intelligent multi-criteria detection device shall include the ability to combine the signal of the thermal sensor with the signal of the photoelectric signal in an effort to react hastily in the event of a fire situation. It shall also include the inherent ability to distinguish between a fire condition and a false alarm condition by examining the characteristics of the thermal and smoke sensing chambers and comparing them to a database of actual fire and deceptive phenomena.
  2. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
  3. The detectors shall provide address setting means electronically and automatically at the control panel.
  4. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  5. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base. No radioactive material shall be used.
  6. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
- J. Intelligent Photoelectric Smoke Detectors
1. The detectors shall use the photoelectric principal to measure smoke density and shall, on command from the control panel, send data to the panel representing the ANALOG level of smoke density. The detector shall provide automatic sensitivity "drift" compensation. The detector shall also provide a "maintenance alert" feature whereby the detector shall initiate a trouble condition should the unit's sensitivity approach the outside limits of the normal sensitivity window.
  2. The detectors shall provide address setting means electronically and automatically at the control panel.
  3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base. No radioactive material shall be used.
  5. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
- K. Duct photoelectric smoke detectors:
1. Detectors shall be analog addressable type.
  2. To minimize nuisance alarms, detectors shall have an insect screen and be designed to ignore invisible airborne particles or smoke densities that are below the factory set alarm

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- point. No radioactive material shall be used.
  3. Removal of the detector head shall interrupt the supervisory circuit of the fire alarm detection loop and cause a trouble signal at the control panel.
  4. Voltage and RF transient suppression techniques shall be employed as well as smoke signal verification circuit and an insect screen.
  5. Remote alarm/power LED indicator with test switch shall be provided. Unit shall be wall or ceiling mounted in readily visible and accessible area near the location of detector; exact location of unit to be approved by the Architect/Engineer.
  6. Detectors shall operate on the same principles and exhibit the same basic characteristics as area type photoelectric smoke sensors. The detector shall operate in air velocities of 300 FPM to 4,000 FPM. Each detector shall interface directly to the system SLC loop without the requirement of interface zone modules.
  7. The unit shall consist of a clear molded plastic enclosure (or remote mounted LED status indicator shall be provided next to the smoke detector) with integral conduit knockouts to provide visual viewing of detector/sensor for monitoring sensor operation and chamber condition. The duct housing shall be provided with gasket seals to insure proper seating of the housing to the associated ductwork. Each unit's sampling tubes shall extend the width of the duct and be provided with porosity filters to reduce sensor/chamber contamination.
  8. The detectors shall provide alarm and power status indication by LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. Steady illumination of the LED shall indicate that the control panel has detected and verified an alarm condition. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  9. The detectors shall provide address setting means electronically and automatically from the control panel.
- L. Intelligent Thermal Detectors
1. The detectors shall use dual electronic thermostats to measure temperature levels in its chamber and shall, on command from the control panel, send data to the panel representing the analog temperature level.
  2. The detectors shall provide address setting means electronically and automatically at the control panel.
  3. The detectors shall provide operational status and alarm state LED. Under normal conditions, the LED shall flash, indicating the detector is operational and in regular communication with the control panel. An output connection shall also be provided in the base for connecting an external remote alarm LED.
  4. The detector shall be semi-flush ceiling mounted and be provided with modular detector head with twist lock base.
  5. Thermal Detectors shall be combination rate-of-rise and fixed temperature- rated at 135°F for areas where ambient temperatures do not exceed 100°F and shall be 200°F for areas where ambient temperatures exceed 100°F but not 150°F. The fixed temperature element shall consist of a fusible alloy retainer and actuator shaft. Detectors shall have a smooth ceiling rating of 2,500 square feet. Detectors shall be located as shown on the drawings and where required by local code authority.
  6. Provide fixed temperature 190°F detector in kitchen and kiln room in lieu of combination rate-of-rise / fixed-temperature type.
- M. Auxiliary AHU Relays: Air Products model MR-101C relays shall be provided for HVAC and AHU control and interface. Relays shall be heavy-duty type with contacts rated up to 10 amps at 120V AC, 60 HZ. Relays shall be provided with NEMA I dust cover assembly and be provided with DPDT contacts as well as activated LED indicator.
- N. Voltage sensing relays: Addressable control modules for voltage sensing relay interface shall be FCM-1.
- O. Monitor Module:
1. Addressable monitor modules shall be provided where required to interface to contact alarm devices. The monitor module shall be used to connect a supervised zone of conventional initiating devices to an intelligent SLC loop.
  2. The monitor module shall provide address setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the monitor module is operational and in regular communication with the control panel, and

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indicate detection of an alarm condition.

- P. Control Module
1. Control/relay modules shall be provided where required to provide audible alarm interface and/or relay control interface. The control module shall be used to connect a supervised zone of conventional indicating devices to an intelligent loop. The zone may be wired class A or class B - field selected. The control module may be optionally wired as dry contact (form C) relay.
  2. The control module shall provide address setting means electronically and automatically at the control panel. A status/alarm LED shall be provided which shall indicate that the control module is operational and in regular communication with the control panel and indicate when the device is actuated via the fire alarm control panel.
- Q. Auxiliary Interface Points: All auxiliary input points (kitchen hoods, water flow, tamper switches, fire extinguishing systems etc.) shall be connected as required and addressed as a separate initiating point of annunciation at the fire alarm panel and any remote annunciator as required.
- R. Water flow switches / Valve supervisory switches shall be provided and installed by the fire protection contractor and connected by the fire alarm contractor. Wiring of these field devices to the fire alarm system shall be the responsibility of the fire alarm contractor. It is the responsibility of this contractor to ensure the proper function of the system. Each fire protection zone (flow switch) and (Valve switch) shall be addressed electronically and automatically at the control panel as a separate point of annunciation at the fire alarm panel. Coordinate exact location with fire protection contractor and civil drawings.
- S. Beam detectors:
1. Microprocessor based beam detectors, consisting of a separate transmitter and matching receiver.
  2. Coverage up to 350 ft. X 60 ft.
  3. LED status indicators for normal (green), alarm (red), and trouble (yellow).
  4. The detectors shall provide address setting means electronically and automatically at the control panel.

2.7 MAGNETIC DOOR HOLDERS, AUTOMATIC FIRE DOORS / SHUTTERS, AND SECURITY GRILLES AND INTERIOR SPACE CONTROLLED ACCESS EGRESS DOORS WITH AUTOMATIC EMERGENCY EGRESS ELECTRIC LOCK EMERGENCY RELEASE

- A. Magnetic fire door hold open devices, interface for automatic roll down fire doors/shutters, and interface for security grilles and controlled access egress doors with emergency egress shall be provided. Coordinate with Division 8 and Architectural Drawings for exact location.
- B. The operation of any alarm in the fire alarm system shall cause the following:
1. Release of the magnetic fire door holding devices, permitting the fire doors to be closed by the door closer.
  2. Permit the automatic roll down fire doors/shutters to close automatically.
  3. Permit the security grilles with emergency egress to open automatically.
  4. Unlock the electrically controlled access doors in all interior spaces.
- C. The magnetic door holders, automatic roll down fire doors/shutters, security grilles, and interior electrically controlled access doors with emergency egress, shall be associated with two smoke detectors located on the ceiling with one on either side of the fire door/shutter, security grille opening, or interior egress path electrically controlled door. The operation of either of these detectors shall also cause the magnetic holder to release the fire door, the automatic fire door/shutter to close, and the security grille with emergency egress to open.
- D. The operation of smoke detectors associated with a magnetic door holder, automatic roll down fire door, security grille, or electrically controlled access door shall transmit a pre-alarm signal to the fire alarm panel.

2.8 REMOTE PAGING UNIT

- A. Remote all-call paging unit or to activate one of the pre-recorded messages over the speaker circuits.

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## 2.9 REMOTE ALPHANUMERIC DISPLAY ANNUNCIATORS

- A. (Where indicated or required by Local Authority Having Jurisdiction) Remote alpha-numeric annunciator(s) to annunciate all system events and duplicate the displayed status at the main FACP. The annunciator(s) shall be an 80-character display similar to the main FACP and operate via the system RS485 or RS232 serial output terminal from the main FACP. The unit shall operate from FACP 24VDC power and function during system power failure while the system resides on standby batteries. The remote annunciator(s) shall include:
1. Integral time/date clock
  2. System reset
  3. System silence
  4. System acknowledge
  5. Display/step switch
  6. Integral trouble buzzer
  7. LCD contrast adjust
  8. Fire Drill Operation
  9. Owner's list of additional remote annunciator control buttons.
- B. Annunciator shall upon command display the first system alarm, last alarm, and system alarm count. The following primary controls shall be visible through a front access panel:
1. 80 character alphanumeric display, LCD, LED, or gas plasma
  2. Individual red system alarm LED
  3. Individual yellow supervisory service LED
  4. Individual yellow trouble LED
  5. Green "POWER ON" LED
  6. Alarm acknowledge key
  7. Trouble acknowledge key
  8. Alarm silence key
  9. System reset key
  10. LED test
  11. Additional control buttons as directed by Owner.

## 2.10 AUXILIARY EQUIPMENT MONITORING

- A. The fire alarm system shall monitor for alarm, supervisory, and trouble conditions; and annunciate the status of the following equipment when provided, or is existing to remain, as part of this project. A failed status shall activate the trouble alarm.
1. Emergency Generator: Run Status
  2. Emergency Generator: Trouble Signal
  3. Fire Pump: Run Status
  4. Fire Pump: Trouble Signal
  5. Emergency Service Communications Systems, as required by NFPA 72 and NFPA 1221.

## PART 3 - EXECUTION

### 3.1 EXPANSION OF EXISTING SYSTEM

- A. Testing of existing systems:
1. Provide complete operational test of existing fire alarm system prior to any demolition or construction. Verify operation of each device, control panel, distribution equipment and associated accessories.
  2. Provide a complete written report to the Architect, indicating any deficiencies of the existing system in relation to each component's intended function. In addition, provide deficiencies of the existing system with regard to current Code, ADA, and Local Accessibility Standards requirements. Provide the written report 14 days prior to any work related to the expansion of the existing system.
  3. Testing of the existing system shall include all areas and all buildings served by the existing system.

- B. Expand the existing system in all expansion or renovation areas to include requirement specified and as required by the local authority having jurisdiction. Verify compatibility of new equipment with existing system.
- C. Provide smoke detectors in the following locations in addition or renovated areas:
1. All paths of egress and adjoining spaces within the same envelope including but not limited to: corridors, hallways, stairs, lobbies, and elevator landings.
  2. At each electrical room, telecommunications/data room, elevator machine room, kiln room, and mechanical room not subject to un-treated or un-filtered outside air.
  3. At each computer lab/room.
  4. At each library or book storage room.
  5. At each storage room, stock room, or warehouse space.
  6. At each pre-K and kindergarten classrooms.
  7. At nurse's area/clinic and patient care/cot areas.
  8. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas without food preparation or cooking equipment.
  9. At each student toilet/restroom. Provide STI protective covers. Do not locate over plumbing fixtures or near partitions.
- D. Provide heat/thermal detectors in the following locations in addition or renovated areas:
1. At each mechanical room subject to un-treated or un-filtered outside air.
  2. At each janitor's closets and laundry rooms.
  3. At each commercial kitchen and adjoining storage rooms; at each food preparation area.
  4. At each employee break room.
  5. At each vocational shop.
  6. At each science, physics, chemistry, or biology classroom and their associated preparation and storage rooms.
  7. At each special needs, life skills, adaptive behavior, developmental classrooms or similar designated areas with food preparation or cooking equipment.
- E. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.
- F. Provide duct smoke detectors in all air handling units with air volumes of 2,000 cfm or larger.
1. Where duct smoke detectors are installed above ceilings, provide external remote status/alarm LED mounted flush with ceiling in close proximity to the duct detector location. If space is open without ceiling, wall mount remote status/alarm LED in close proximity to the detector between 96 and 108-inches AFF, or as directed by Owner.
- G. Provide duct smoke detectors on outside air units only as required by local Code and / or AHJ.
- H. Provide VESDA type detectors at the following locations when appropriate:
1. Atriums to avoid exposed conduits.
  2. High ceiling areas 25 feet and higher where maintenance of spot type detectors will be difficult.
  3. Skylights to avoid exposed conduits.
  4. Coolers/Freezers 200 square feet and larger.
- I. Provide manual pull stations at each exterior exit and at each exit from all floors only if required by local AHJ or if the building is not fully sprinklered. Provide one manual pull station at the central reception area as directed by Owner.
- J. Provide weatherproof exterior audio/visual alarm devices mounted on the building at the exact location as directed by Architect:
1. Main entry.
  2. Courtyards and outdoor assembly areas adjacent to the building.
  3. Mechanical yards adjacent to the building.
  4. Covered playgrounds or covered assembly areas adjacent to the building.
  5. Additional locations where indicated on drawings.
  6. Outdoor paved play areas.
- K. Provide audio and visual alarm devices in all areas normally occupied by students or minors and all common use areas.

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- L. Provide beam type detectors at the following locations when appropriate:
  - 1. Atriums.
  - 2. High ceiling corridors where maintenance of spot type detectors may be difficult.
  - 3. Areas with skylights.
- M. Provide audio and visual alarm devices in all areas normally occupied by students or minors.
- N. Provide carbon monoxide detection and smoke detection devices in all areas designated as day-care for minors.
- O. Provide carbon monoxide detection in classrooms and other instructional spaces served by a fuel-burning appliance, fuel-burning HVAC equipment (including roof mounted equipment), or with gas fuel outlets for connection to portable fuel-burning space heaters and appliances such as Bunsen burners which are typically used in laboratories or science classrooms.

### 3.2 GENERAL REQUIREMENTS

- A. Installation shall include the delivery, storage, setting in place, fastening to the building structure, interconnection of the system components, alignment, adjustment and all other work, whether or not expressly specified, which is necessary to result in a tested and operational system.
- B. All installation practices shall be in accordance with, but not limited to, the specifications and drawings. Installation shall be performed in accordance with the applicable standards, requirements and recommendations of NFPA 72 and the National Electrical Code and any authorities having jurisdiction. Proper protection against corrosion shall be provided on all electrical equipment in accordance with the requirements of the National Electrical Code. The installation shall conform to all manufacturers' recommendations.
- C. All equipment shall be firmly secured in place unless requirements of portability dictate otherwise. Fastenings and support shall be adequate to support their loads with a safety factor of at least three.
- D. All boxes, equipment, etc., shall be plumb and square. The contractor must take such precautions as are necessary to prevent and guard against electrostatic hum, to supply adequate ventilation, and to install the equipment to provide reasonable safety for the operator.
- E. Visual displays, GUIs, or other indicators for main fire alarm panel and all remote annunciators shall be at maximum 66 inches AFF.
- F. All remote booster and associated equipment panels shall be mounted with top of enclosure maximum 66 inches AFF.
- G. In the installation of equipment and cables, coordinate with Architectural drawings for possible conflicts with millwork, casework, marker boards, furniture, lockers, etc., and notify the architect of any discrepancies. Verify modifications before proceeding with installation.
- H. Mount end-of-line resistor for each box circuit in backbox located at the last manual alarm station or automatic initiating device in a circuit. Mark device accordingly in the field.
- I. Provide three dedicated Cat 6 cables from MDF/IDF to fire alarm panel. Cable shall be installed in 3/4" conduit. Two cables for phone POT lines and one Ethernet data connection.
- J. Upright and/or Wall Post-Indicating Valve: Provide conduit and wiring from fire alarm control panel to post-indicating valve if electronically supervised, coordinate exact location of PIV with fire sprinkler contractor prior to rough-in. Coordinate final location with Civil Drawings and Fire Protection Contractor. Where equipment is located inside a vault, stub required conduit inside vault, turn up and cap.
- K. Contractor shall submit on completion of system verification, a point-by-point check list indicating the date and time of each item inspected and issue a certificate confirming that the inspection has been completed and the system is installed and functioning in accordance with the Specifications prior to date of substantial completion.

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- L. Provide remote alphanumeric display annunciators in the administrative area in constantly attended area, as required by the Local AHJ, and additional annunciators where indicated on the drawings, as directed by Owner / Architect.
- M. Alarm devices shall be ceiling mounted unless indicated specifically otherwise. Alarm devices in Mechanical, Electrical, Communications, IDF / MDF Rooms and Central Plant shall be wall mounted and coordinated with other equipment, piping and ductwork.
- N. Provide combination speaker strobes. Provide strobe only alarms when additional speaker placement will compromise voice intelligibility. Provide horn/strobes in coolers and freezers.
- O. Detectors shall be installed per NFPA 90A and be listed with the fire alarm control panel.
- P. Auxiliary Equipment Monitoring Wiring and connection to equipment shall be the responsibility of the fire alarm contractor.
- Q. Power for magnetic door holders shall be provided from the nearest receptacle circuit wired through fire alarm relay.
- R. Smoke detectors shall be mounted to a 4-inch octagon box with hanger bar or with box secured to building structure.
- S. Provide power via 120-volt, 20-Amp dedicated circuits with lock-on provisions at the respective circuit breaker for each new main fire alarm control panel, each new panel extender and each new remote power supply at no additional cost to the Owner. The complete fire alarm system shall be powered under emergency power when emergency life safety power is available at the project site. When emergency life safety power is not available at the project site, power shall originate from the nearest available 120-volt panel, or as indicated.

### 3.3 CABLE AND BOXES INSTALLATION

- A. All circuits shall be protected to avoid interruption of service due to short-circuiting or other conditions, which might adversely affect the connected devices. Each individual signaling circuit shall be classified as a circuit pair.
- B. All cabling in racks, cabinets and junction boxes shall be neatly strapped, dressed and adequately supported. Cable installation shall conform to good engineering practices and to the standards of the National Electrical Code.
- C. Cables shall be terminated with the proper connector required for the associated operation of the equipment to which it is connected. Screw terminal blocks shall be furnished for all cables, which interface with racks, cabinets, consoles or equipment modules.
- D. All cables within a rack, console or junction box shall be grouped according to the signals being carried to reduce signal contamination.
- E. Where shielded conductors enter a panel or enclosure, and where power wiring exists, provision shall be made to provide physical isolation of signal and power conductors.
- F. Supply and install all fittings and accessories whether or not they are specified, required for proper, safe and reliable operation of the system.
- G. All wire shall be installed in an approved conduit/raceway system (except where permitted by NEC and the local authority having jurisdiction). Maximum conduit fill shall not exceed 40%.
- H. Minimum conduit size shall be 3/4" EMT with insulated bushings. Install conduit per engineered shop drawings.
- I. Systems utilizing open wiring techniques with low smoke plenum cable shall provide conduit in all inaccessible locations, inside concealed walls, all mechanical/electrical rooms, or other areas where wiring might be exposed to view and or subject to damage.

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- J. All vertical wiring and all main trunk/riser wiring shall be installed in a complete raceway/conduit system. All riser boxes shall be adequately sized for the number of conductors transversing the respective box as well as the number of terminations required.
- K. All junction boxes containing fire alarm wiring are to be painted red.
- L. All plenum wiring is to be installed parallel and perpendicular to the building structure. Cable shall be bundled with cable ties on a maximum of 2'-6". Install cables in D-ring hangers secured to the structure at a maximum of 5' on center. Cable shall not lie on ceiling grid or ceiling tiles, light fixtures, piping, ductwork or foreign equipment.
- M. The system ground is to be connected to the local ground bus. Under no conditions shall the AC neutral either in a power panel or in receptacle outlets be used for a reference ground.
- N. All wiring shall be in accordance with NFPA 72, the National Electrical Code, and Local Codes. All wiring sizes shall conform to recommendations of the equipment manufacturer, and as indicated on the engineered shop drawings.
- O. All wire shall be UL Listed FPL for limited energy (300V) and fire alarm applications and shall be installed in conduit. Limited energy FPLP or MPP wire may be run open in return air ceiling plenums provided such wire is UL Listed for such applications and is of the low smoke producing fluorocarbon type and complies with NEC Article 760 and approved by the local authority having jurisdiction.
- P. No other wiring shall be run in the same conduit as fire alarm wiring.
- Q. All fire alarm wiring to be red. All fire alarm circuits shall be identified at each termination and at each 25 feet between terminations.
- R. Copper wiring leaving or entering main building shall be protected on both ends with surge suppression; otherwise use fiber-optic cabling.

### 3.4

#### ALARM SYSTEM SEQUENCE OF OPERATION

- A. General:
  - 1. All fire alarm circuits shall be electrically supervised.
  - 2. Automatic response functions shall be accomplished by the first device initiated. Alarm functions resulting from initiation by the first device shall not be altered by subsequent alarms. An alarm signal shall be the highest priority. A pre-alarm signal shall have second priority and supervisory or trouble signals shall have third and fourth level priority. Signals of a higher level priority shall take precedence over signals of lower priority even though the lower priority condition occurred first.
- B. Fire alarm operating sequences shall be as follows:
  - 1. Activation of any automatic detector, manual station, fire suppression system, sprinkler flow switch or any other system required by NFPA 72 to be monitored to initiate an alarm condition shall cause the location of the alarm to be identified in an audible and visual manner at the building fire alarm control panel (FACP), and shall initiate the following events:
    - a. The system common alarm LED on the CPU Module shall flash. The internal audible trouble device shall sound. Acknowledging the alarm condition shall silence the audible trouble device and revert the flashing common alarm LED to a steady state.
    - b. The 80-character display shall indicate all applicable information associated with the alarm condition including: zone, device type, device location based on actual room graphic name and number (not architectural plan names and numbers), and time of alarm. Location and zoning messages shall be custom field programmed to respective premises.
    - c. Any remote or local annunciator LED's associated with the alarm point shall be illuminated as herein specified.
    - d. The remote signaling connection shall be activated relaying the alarm signal to an approved central station (central station connection and service provided by

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- Owner). Point ID and descriptor must be sent and received.
- e. All automatic events programmed to the alarm point shall be executed and the associated indicating devices and/or outputs activated.
  - f. De-activate local sound reinforcement systems that are not UL listed nor integrated with the fire alarm system control panel for providing fire alarm or mass notification instructions. Building wide public address systems shall remain active only for manual mass notification. Public address system auxiliary audio inputs used for background music or other remote non-emergency audio sources shall be silenced to only allow priority level manual mass notification using the public address system.
  - g. Activate all audible/visual alarm devices. Where prerecorded voice announcement is required or specified, the prerecorded announcement shall be preceded with attention tone(s), followed by the approved prerecorded announcement and continue in a cycle until the system is reset. Manual voice announcement shall interrupt the prerecorded cycle and the prerecorded cycle shall resume automatically after three minutes.
  - h. De-activate all HVAC systems including low speed high volume (LSHV) circulating blade type fans.
  - i. De-energize the kitchen hood supply/exhaust fans as required by local authority having jurisdiction.
  - j. Close all related smoke dampers.
  - k. Close all related smoke/fire dampers.
  - l. Release all magnetic door hold open devices.
  - m. Release the electric strike, unlocking, but not unlatching, locked doors controlled by an access control system.
  - n. Release Counter Shutters and hold-open devices on all fire and smoke doors.
  - o. Open all security grilles with emergency egress.
  - p. Activate to close all related fire and smoke doors and shutters.
  - q. Activate signaling connection to the elevator as required by the local authority having jurisdiction.
  - r. Signal the building automation system and Owner's security / police personnel as directed by Owner / Architect. The audible alarms shall be inhibited from being silenced for a period of 3 minutes after commencing operation unless alarm is acknowledged, and appropriate action has been taken.
  - s. Activate automatic recall operation of elevators as required by local authority having jurisdiction.
  - t. Record all events on the system printer.
- 2. Activation of duct mounted smoke detector on the HVAC equipment, or a smoke detector mounted in the return/supply air stream of any fan shall shut down all units as required by NFPA. The activation of one of these detectors shall initiate the Alarm Sequence of Operation.
  - 3. Activation of a control valve supervisory switch shall initiate the following events:
    - a. The activation of any sprinkler valve supervisory (tamper) switch shall activate the system supervisory service audible signal and illuminate the LED at the building fire alarm control panel (FACP). Differentiation between valve tamper activation and opens and/or grounds on the initiation circuit wiring shall be provided.
    - b. Activation of a sprinkler system control valve supervisory switch shall not prevent the events listed under Article 3.4.
    - c. Restoring the valve to the normal position shall cause the supervisory service audible signal to pulse, indicating the restoration to normal position. The supervisory service reset key shall be provided to silence the audible signal.
  - 4. Activation of the smoke detector and heat detector in the elevator machine room and at top of elevator shaft shall cause the elevators' controllers to be tripped by way of the shut trip breaker, and shall also initiate the events listed under Article 3.4.
  - 5. Any subsequent fire alarm shall reactivate the alarm indicating appliances and activate the respective control sequences described above.
  - 6. Upon silencing the alarm, all visible alarm devices shall remain active until system reset, and all local sound reinforcement systems de-activated by the fire alarm system shall resume normal operation.
  - 7. Upon reset of the fire alarm control panel, HVAC units shall be capable of being started, and resume normal operation.

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- C. Activation of the manual evacuation pull (drill) switch shall operate the alarm indicating appliances and de-activate local sound reinforcement system without causing other control circuits to be activated. However, should true alarm occur, all alarm functions should occur as described.
- D. ALARM VERIFICATION shall be field programmed for each respective detector. Global verification will not be acceptable. The verification sequence is activated after a "check" procedure and the panel will wait a field programmable delay period (0-50 seconds) then proceed to re-sample the detector for continued presence of smoke. If the alarm condition still exists or a non-verified device is actuated during the verification period, the system will then initiate all alarm sequences specified herein. The system shall incorporate the ability to log in memory the number of verification events that have occurred for each selected device.

### 3.5 EQUIPMENT IDENTIFICATION

- A. Each new panel or equipment enclosure shall be provided with a permanently engraved or embossed or silkscreen identification tag. The tag shall include the following information:
  - 1. Name of manufacturer.
  - 2. Manufacturer's equipment description.
  - 3. Serial number and model number.
  - 4. Voltage and current rating.

### 3.6 SPARE PARTS AND TOOLS

- A. Interchangeable Parts: All spare parts furnished shall be directly interchangeable with the corresponding components of the installed system. Spare parts shall be packaged and identified by nameplate, tagging, or stamping. Spare parts shall be delivered to the site in unopened cartons for storage as directed by the Owner.
- B. Spare Parts: Provide minimum of one, or 5% of renovation area total, whichever is greater unless noted otherwise.
  - 1. Spare shut down modules
  - 2. Spare detectors of each type in the system
  - 3. Spare alarm indicating devices of each type in the system
  - 4. Spare manual pull stations
  - 5. Spare protective covers of each type in the system.
  - 6. Spare relays/controls required for connection to smoke and fire/smoke dampers
  - 7. Devices listed above are to be installed as directed by Architect/Engineer or local code authorities at no additional cost to the Owner. Unused spare parts are to be parts for Owner's cabinet.
- C. Provide one smoke, heat and carbon monoxide detector testing kit. SDfire #TF2823 with Solo Testfire #2001 tester with 15-foot access pole and three 4-foot pole extensions, detector removal tool, and carrying bag.
- D. Provide two copies of the final software programmed into the fire alarm system.
- E. Parts list: Furnish a list, in duplicate, of all other parts and accessories the manufacturer of the system recommends to be stocked for maintenance.

### 3.7 KEYS

- A. Keys and locks for all equipment shall be identical to the existing building master key for the fire alarm system.

### 3.8 SMOKE DAMPERS AND FIRE/SMOKE DAMPERS

- A. Smoke dampers and combination fire/smoke dampers shall be controlled by an automatic alarm initiating device. Smoke dampers installed to isolate the air handling system shall be arranged to close automatically when the system is in alarm.
- B. Coordinate motor operator voltage with supplier.
- C. Open all dampers prior to starting air handling equipment.



- D. Provide 120V power from nearest general purpose 20A receptacle circuit as required, or as noted otherwise.

### 3.9 GRAPHIC FLOOR PLANS FOR AHJ SITE PERMITTING INSPECTION AND OWNER USE

- A. It is the intent of these specifications that the fire alarm system shall pass AHJ inspection on the first try. The fire alarm system shall be fully functional, commissioned, and mapped both on fire alarm graphic maps and fire alarm annunciator device descriptions to fully and correctly described the device type and detailed location. Provide color coded floor plans detailed with actual room names, actual graphic room numbers as directed by the Owner and adequate information to direct people to the fire alarm devices in alarm and to exits with non-fading floor plan media. Do not use architectural plan room names and numbers. Fire alarm maps shall include all relevant building information and fire alarm device information as required for the local AHJ permitting site walk-through inspection.
- B. Each plan shall clearly relate the room numbers on the annunciator to the area description on the floor plan. All fire alarm devices located to correspond with the annunciator.
- C. Provide two color coded floor plans for Owner use that shall be solvent welded in acrylic plastic.
  - 1. Mount in an extruded aluminum frame next to the main fire alarm control panel.
- D. Install graphic floor plans as directed by Architect/Owner prior to substantial completion. Each area or room designation shall be verified with the fire alarm device during testing.

### 3.10 ADDITIONAL REQUIREMENTS

- A. Coordinate with Owner for appropriate off-site monitoring service and communication technology to be used. Provide all necessary programming for interfacing with the Owner's on-site and off-site remote signaling receiving station, including programming of descriptors and addresses at the receiving station.
- B. The contractor is to ensure all areas of the renovation and new construction are covered with visual and audio alarm devices for occupant notification of a fire alarm including remote portable or temporary buildings.
- C. Coordinate door hold devices with door and door hardware.
- D. Provide interface with and coordinate shunt-trip circuit breakers and control devices with kitchen hood fire control systems (where new kitchen hood fire control systems are provided) and elevator equipment (where new elevators are provided).
- E. Alarm circuit power supplies and circuiting shall be designed and installed to accept an additional five (2) 110cd visual devices for future expansion. The initial design shall not exceed 70% of the rated power supply and circuit capability with the two additional 110cd devices installed.
- F. Provide programming or re-programming of all hot keys as directed by Owner including, but not limited to, fire drill, AHU shutdown bypass, horn/strobe disable, elevator test.

### 3.11 COMMISSIONING THE SYSTEM

- A. The installing contractor shall be responsible for verifying that each new or relocated component of the system is fully operational and in conformity with the specifications. He shall also be responsible for insuring that all elements function together as a system in accordance with the specifications.
- B. A state licensed and factory trained technical representative of the manufacturer with NICET Level 3 minimum certification shall supervise the final control panel connections and testing of the system. Upon completion of the acceptance tests, the owner and/or his representatives shall be instructed in the proper operation of the system.
- C. The installing contractor shall functionally test each and every device in the entire system for proper operation and response. Any new or relocated items located within the construction or

### EXPANSION OF EXISTING FIRE DETECTION AND ALARM SYSTEM

renovation area found not properly installed or non-functioning shall be replaced or repaired and retested. The final test indicating a fully functional fire alarm system shall be recorded; electronic Excel and printed copy submitted to the Architect, Engineer and Owner.

- D. The installing contractor shall provide a complete written report and printout of the functional test of the entire system after all existing deficiencies of the existing system have been corrected by the Owner, or as directed by the Owner. The test report shall be signed and dated by the licensed fire alarm superintendent responsible for supervising the final system test and checkout. This test shall be completed and accepted by the Owner prior to testing for the local Fire Marshall.
- E. The installing contractor's fire alarm superintendent shall test the entire system in the presence of the local authorities having jurisdiction. The contractor shall be responsible for making any changes, adjustments, or corrections, as may be required by the local authorities. The Contractor shall affix his certification label and installation certificate to the interior of the main fire alarm control panel.
- F. The testing and acceptance shall be performed within 30 days after the fire alarm installation is completed. The test shall be performed by a minimum of two qualified fire alarm system technicians acceptable to the authority having jurisdiction. The test which is a comprehensive 100 percent inspection and test of all fire alarm system equipment shall include the following:
  - 1. Fire alarm control equipment: a visual and functional test of the fire alarm control and auxiliary control equipment.
  - 2. A visual inspection shall be conducted to establish that all electrical connections and equipment, as required, are properly installed and operating.
  - 3. A functional fault simulation test shall be conducted on all relevant field wiring terminations to ensure that wiring is properly supervised as required.
  - 4. Indicators shall be tested to ensure proper function and operation.
  - 5. Control panel auxiliary functions shall be functionally tested to verify proper operation.
  - 6. Control panel supervisory and alarm current readings shall be taken to verify that the control panel has the appropriate power supplies and standby batteries to operate the system as required. A three-minute general alarm stress test, both under AC power and standby power, shall be conducted to further ensure complete operation of the system.
  - 7. Fire alarm peripheral devices; All fire alarm peripheral devices shall be functionally tested and the location and testing information recorded for each device.
  - 8. Manual initiating devices:
    - a. Each manual fire alarm station shall be functionally tested for alarm operation.
    - b. Each manual fire alarm station shall be functionally tested for proper wiring supervision.
  - 9. Automatic initiating devices:
    - a. Each automatic initiating device shall be activated in accordance with manufacturer's instructions to ensure proper operation.
    - b. Each automatic initiating device shall be functionally tested for proper wiring supervision.
    - c. Each automatic initiating device shall be inspected to ensure proper placement and mounting as required by specifications.
  - 10. Alarm signaling devices:
    - a. Each alarm signaling device shall be tested and decibel reading taken at 10' from the device and recorded to ensure proper operation. Each area's voice alarm signaling devices shall be tested for intelligibility.
    - b. Each alarm signaling device shall be functionally tested for proper wiring supervision.
    - c. Decibel reading shall be taken to ensure that the alarm signal level can be clearly heard in all areas of the facility.
    - d. All visual alarm indicators shall be functionally tested to ensure proper operation and that they are clearly visible.
  - 11. Elevators: Each elevator shall be tested and automatic recall function verified.
  - 12. Reporting: Upon completion of the initial verification audit, a report shall be sent to the Architect/Engineer indicating that all fire alarm equipment has been tested and is in 100 percent operation. The report shall also contain the audit testing information as to the location and operational status of each peripheral device. The 100 percent audit shall be performed by a factory-trained representative. The report shall include the voice intelligibility performance in each area and indicate compliance with NFPA and local AHJ requirements.

- G. It is the intent of these specifications and of the Architect/Engineer that a continued program of system maintenance will be provided by the Owner in compliance with NFPA 72. It is mandatory that the installing Contractor provide such services and make available these services to the Owner upon completion of the project.
- H. Upon completion of installation and full acceptance testing, submit NFPA 72 certificate of compliance that the total fire alarm system, including any subsystems, is fully functional and that the components are UL listed for function intended.

3.12 SUBSTANTIAL COMPLETION

- A. Final acceptance of the FIRE ALARM SYSTEM by the owner, local code authorities and Occupancy Permit has been issued.
- B. All fire alarm system shop drawings, operating and maintenance manuals, maps and as-built drawings shall be submitted to and accepted by the Architect / Owner prior to date of substantial completion.

END OF SECTION

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